HSHB-ME-SH (40)

MEMORANDUM FOR Commander, U.S. Army Environmental Center, ATTN:

SFIM-AEC-EC, Bldg E4435, Aberdeen Proving Ground,

MD 21010-5401

SUBJECT: Interim Final Report, Lead-Based Paint Contaminated

Debris - Waste Characterization Study No. 37-26-JK44-92, May 1992

- May 1993

Three copies of this report are enclosed. Questions regarding

this report may be directed to Ms. Veronique Hauschild or Mr.

John Resta, Chief, Hazardous and Medical Waste Branch.

Additional comments or concerns may be directed to me. We can be

contacted at DSN 584-3652 or commercial (410) 671-3652.

FOR THE COMMANDER:

Encl JESSIE B. CABELLON

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Chief, Waste Disposal Engineering

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INTERIM FINAL REPORT

LEAD-BASED PAINT CONTAMINATED DEBRIS

WASTE CHARACTERIZATION STUDY NO. 37-26-JK44-92

MAY 1992 - MAY 1993

Distribution limited to U.S. Government agencies only; protection

of privileged information evaluating another command; Jul 93.

Requests for this document must be referred to Commander, U.S.

Army Environmental Center, ATTN: SFIM-AEC-EC, Bldg E4435,

Aberdeen Proving Ground, MD 21010-5401.

EXECUTIVE SUMMARY

INTERIM FINAL REPORT

LEAD-BASED PAINT CONTAMINATED DEBRIS

WASTE CHARACTERIZATION STUDY NO. 27-26-JK44-92

MAY 1992 - MAY 1993

1. PURPOSE. This study was performed to assess the waste

characteristics of debris that is contaminated with lead-based

paint (LBP). The study focused on the debris generated from the

demolition of Army WWII structures but also addresses other waste

items such as those resulting from abatement and renovation

activities.

2. CONCLUSIONS.

a. Characterization: Whole-Building

Demolition Debris. The findings showed that (statistically)

whole-building demolition debris (e.g., Army WWII-era structures)

can be characterized as nonhazardous waste so long as certain

assumptions/assertions are made:

(1) Other hazardous components such as asbestos or PCBs

(from light ballasts and roofing tars) are not present/or are

removed and disposed separately.

(2) Metals components such as ductwork, furnace/boilers,

piping, or siding are removed to the extent feasible as scrap

materials for reuse/recycling.

(3) All remaining material (i.e., all those materials that

were included in the sampling process such as both painted and

unpainted wood components, brick, concrete/foundation material)

must comprise a single wastestream at the point of generation

(when the building is demolished). This wastestream must be

handled as a single, discrete wastestream and disposed of all

together.

b. Characterization: Small-Scale

Debris. Debris that is generated during renovation, maintenance,

or abatement activities such as paint chips, blast grit/media, or

personal protective equipment is more likely to be characterized

as "hazardous" due to the concentrated mass of LBP. For these

types of wastes, hazardous waste generation can be minimized

through waste segregation techniques. For some wastes, cost

savings can be achieved through minimizing sampling and analyses.

c. Disposal.

(1) Nonhazardous Waste. While disposal in a

construction/demolition (C/D) debris landfill may be appropriate

and relatively inexpensive at this time, generators should

consider other options that offer more than an "out-of-sight,

out-of-mind" solution. In fact, new/impending restrictions on

C/D debris landfills may force the cost of this disposal option

to greatly increase. Other options may be less expensive and/or

more environmentally acceptable. State and/or local regulatory

involvement will be necessary when assessing the feasibility of

such alternatives.

(2) Hazardous Waste. The volume of LBP-related hazardous

waste should be minimized to the extent most feasibly and

economically possible. This can be done through careful

assessment of operations and segregation of wastestreams as well

as separation of contaminated items or removal of LBP.

(3) Recycling. Many items such as metal duct work, piping,

and siding can be salvaged from buildings that are to be

demolished for recycling/reuse. Recycling can provide economic

gains in addition to the environmental benefits associated with a

reduced wastestream.

3. RECOMMENDATIONS.

a. Identify whole-building demolition debris wastestream

populations that meet the descriptions discussed in this report.

b. Characterize such waste as nonhazardous, pending concurrence

from state and local agencies.

c. Identify other sources of lead-paint containing waste and

debris. Determine appropriate waste segregation and management

procedures based on cost-analyses and findings discussed above.

d. Evaluate the potential for environmental media (e.g., soil)

contamination at demolition sites, specifically with regards to

future-use scenarios and human health-risk.

e. Develop SOPs for demolition site operations to minimize

environmental contamination and health hazards.

f. Assess current disposal procedures for demolition debris.

Correct deficiencies/make amendments to contracts and/or SOPs

with

regard to final destination, liabilities, and control.

g. Evaluate disposal options and alternatives with regards to

environmental and other regulatory requirements, cost, and other

benefits/disadvantages.

TABLE OF CONTENTS

Paragraph Page

1. REFERENCES 1

2. PURPOSE 1

3. BACKGROUND 1

a. General 1

b. Regulatory Basis 1

c. Initial Argument 1

(1) Sample Preparation 1

(2) Mobility of Lead 2

(3) Current Landfills 2

(4) Buildings 3

(5) Other 3

d. Impact on Army 3

e. Army Initiative 3

f. Regulatory Concurrence 3

4. APPROACH AND METHODOLOGY 4

a. Establishing the Waste Population 4

b. Establishing the Sample Group 5

c. Composite Sampling 5

d. Laboratory Analyses and Quality Assurance/Quality

Control (QA/QC) 6

e. Data Evaluation 7

5. FINDINGS AND DISCUSSION 8

a. Army WWII-Era Demolition Debris -- Pilot Projects 8

b. Army WWII-Era Demolition Debris --Overall 8

c. Building Demolition Debris -- General 8

d. Waste Generated by Abatement, Renovation,

Maintenance 9

e. Environmental Concerns and Best Management

Practices (BMPs) 10

(1) Soil Contamination and Future Use 10

(2) Storm Water Runoff 11

(3) Dust Control 11

f. Disposal Options and Alternatives 11

(1) Nonhazardous Waste 11

(2) Hazardous Waste 11

(3) Recycling 12

6. CONCLUSIONS 12

a. Building Demolition Debris 12

b. Other LBP-Contaminated Waste Items 13

c. Environmental Concerns and BMPs 13

d. Disposal Options and Alternatives 14

(1) Nonhazardous Waste 14

(2) Hazardous Waste 14

(3) Recycling 14

7. RECOMMENDATIONS 14

Appendices

A - REFERENCES A-1

B - USAEHA SAMPLING PROTOCOL B-1

C - BUILDING COMPONENTS: SUBSAMPLE LOCATIONS C-1

D - CORRESPONDENCE WITH STATE OF ALABAMA D-1

E - GRAPHICAL DISPLAY OF DATA NORMALITY E-1

F - SUGGESTED GUIDELINES FOR CHARACTERIZATION OF (COMBINED

FROM ALL PILOT STUDIES) F-1

G - SMALL SCALE DEBRIS CONTAINING LEAD-BASED PAINT G-1

H - SOIL LEAD CLEAN-UP LEVELS H-1

I - EPA BMPS FOR STORM WATER RUNOFF & DUST CONTROL I-1

J - DISPOSAL ALTERNATIVES

INTERIM FINAL REPORT

LEAD-BASED PAINT CONTAMINATED DEBRIS

WASTE CHARACTERIZATION STUDY NO. 37-26-JK44-92

MAY 1992 - MAY 1993

1. REFERENCES. Appendix A contains a list of the materials

referenced in this report.

2. PURPOSE. The primary purpose of this study was to assess the

waste characteristics of demolition debris from buildings painted

with lead-based paint (LBP), particularly Army WWII structures.

The study also addresses other waste items such as those

resulting from abatement and renovation activities of structures

painted with LBP.

3. BACKGROUND.

a. General. Lead-based paint has been a growing concern

both within DOD and in the private sector for well over the past

year. Most of the focus has been on the prevention of childhood

lead-poisoning. The increasing alarm over lead hazards has,

however, resulted in a host of related quandaries. One of these

problems involves the disposal of waste/debris (such as paint

chips and painted building components, that contains LBP.

b. Regulatory Basis. New environmental regulations

specifically addressing wastes managed under the Resource

Conservation and Recovery Act (RCRA) also prompted the assessment

and waste characterization of building debris. Specifically,

debris that was "inherently" hazardous due to metals

constituents (e.g., the lead in certain paints) was addressed.

Details are provided in the Background section of the USAEHA

Sampling Protocol for Building Demolition Debris and Buildings

Painted with Lead-Based Paint (Appendix B).

c. Initial Argument. The USAEHA has identified several

reasons why using the standard hazardous waste identification

technique [i.e., the Toxicity Characteristic Leaching Procedure

(TCLP)] to characterize demolition debris may be inappropriate

and unnecessary. While these reasons do not qualify as an

exemption from the regulatory requirements, they are presented

below for consideration during the discussions and conclusions

presented later in this report.

(1) Sample Preparation. The TCLP requires particle size

reduction for a sample if the solid particles are smaller than 1

cm in their narrowest dimension and are capable of passing

through a 9.5 mm (0.375 inch) standard sieve (reference 1). The

grinding, shredding, or other processes used on painted debris to

meet this requirement change the physical properties of the waste

to the degree that the leaching characteristics themselves are

greatly enhanced/exaggerated. As the surface area of the sample

particles increases, so does the likelihood that more lead (or

other constituent) will leach. Since the TCLP extracts toxic

constituents of a solid waste "in a manner EPA believes

stimulates the leaching action that occurs in landfills"

(reference 2), it is inappropriate that the waste itself is first

altered to a point that is atypical of a real landfill scenario.

(2) Mobility of Lead. The TCLP was designed to reflect

the "leachability" of contaminants into and through soil

(presumably to ground water). However, some evidence (references

3-8) has suggested that the low solubility of lead and its

tendency to be trapped by organic matter in soil

results in much less migration than is assumed by the TCLP.

While lead concentrations exceeding the Safe Drinking Water Act's

Maximum Contaminant Level (MCL) of 0.05 mg/L have been identified

in leachate from some construction/ demolition (C/D) debris

landfills, the lead is always diluted or attenuated to below

drinking water standards before reaching drinking water wells

(reference 8).

(3) Current Landfills. As a "newly identified"

potentially hazardous wastestream, the appropriateness of past

disposal practices must be addressed. If such a wastestream was

deemed to be hazardous, many current C/D debris landfills could

be faced with clean-up problems. Without ground-water monitoring

requirements for such landfills it is difficult to "prove" that

lead leachate and migration problems do not actually exist.

(a) One such landfill (Army owned and operated) with an

in-place ground-water monitoring system has been identified and

evaluated; 2 years-worth of analytical data indicated that no

lead was observed above background residual concentrations

(reference 9). However, as stated above, there are cases of

elevated lead in the leachate from some C/D debris landfills.

Still, no evidence linking such leachate to ground-water

contamination has been identified.

(b) Of course, the rate/degree of lead transport through

the soil and to ground water is dependent on such factors as soil

type, pH, and depth to the water table. Low pH (acidic)

environments with a high water table are more prone to ground-

water contamination than where soils are neutral or alkaline and

the ground water is at a significant depth. In fact, it is

because there are potential adverse environmental effects on

ground water and adjacent surface water that many states are now

implementing C/D landfill requirements (reference 8). Some of

these requirements are similar to those for municipal solid waste

(MSW) landfills; others include liner and leachate collection

systems, ground-water testing, and surface water monitoring. In

addition, some states are banning disposal of C/D debris in MSW

landfills. With these added controls to C/D landfills, there

should be less concern for potential environmental threats.

(4) Buildings. The buildings as they currently stand

expose more painted surface area to the elements (e.g., rain and

snow) than they would if demolished and placed in a (debris)

landfill. If leaching lead were a significant problem, the

buildings (present since WWII) would have, presumably, created a

more obvious "contamination" problem. While "contaminated" soil

has been identified adjacent to some residential structures

painted with LBP during childhood lead-poisoning prevention risk

assessments, stratified sampling has indicated highest

concentrations in the surface soil with little or no

contamination deeper than 1 to 2 feet (reference 10).

(5) Other. Other considerations are perhaps more socio-

political and/or economic in basis. For instance, the option of

disposing such debris as hazardous is not only extremely costly,

but -- due to the large volume of waste involved -- it would take

up a large amount of hazardous waste (HW) landfill space which

could be used for wastes which pose more significant or proven

health threats. In addition, disposal of LBP debris as HW

increases the costs associated with abatement activities. The

prioritization/completion of many abatement operations may be

dependent on funding which in part will be designated for

disposal costs.

d. Impact on Army. The Army was able to assess a direct and

significant impact (reference 11) on various activities to

include the Buildings Reduction Program which involves the

demolition of WWII-era structures at a majority of Army

installations. As originally established, the project plans for

this program did not include funds or plans to sample

and characterize the waste. More importantly, funds had not been

allocated for hazardous waste disposal. In addition, potential

hazardous waste disposal requirements have also created several

obstacles during the implementation of the Army's childhood lead-

poisoning prevention program.

e. Army Initiative. At the request of the Office of the

Director of Environmental Programs and the U.S. Army

Environmental Center (reference 12), the USAEHA developed the

Sampling Protocol included as Appendix B and performed several

pilot projects to establish a baseline waste characterization of

demolition debris from Army WWII structures. During the course

of the pilot studies, the Sampling Protocol was occasionally

modified to address problems/issues identified during field

and/or laboratory operations.

f. Regulatory Concurrence. The finalized Sampling Protocol

was officially provided to the Technical Assessment Branch and

the Waste Treatment Branch of the Office of Solid Waste, EPA

Headquarters for comment (reference 13). The EPA response letter

stated "Overall, we like [the] protocol" (reference 14).

Specific comments made by the EPA are addressed in the discussion

section below.

4. APPROACH AND METHODOLOGY. The procedures described in the

Sampling Protocol were used to obtain samples from eight

installations. The Table below identifies these installations.

The following points of discussion address the various procedures

outlined in the protocol and specific problems encountered.

TABLE. PILOT PROJECT INSTALLATIONS

(1) Fort Knox, KY

(2) Aberdeen Proving Ground, MD

(3) Fort Meade, MD

(4) Fort McClellan, AL

(5) Fort Devens, MA

(6) Fort Riley, KS

(7) Fort Gordon, GA

(8) Fort Jackson, SC (incomplete)

a. Establishing the Waste Population. We defined the waste

population as all debris generated from a specified demolition

action (such as at a given installation, within a given

timeframe, by a specified contractor) and to include all building

components that are to be disposed of together (in a landfill).

This definition of wastestream population has perhaps

been the most controversial issue of the overall problem.

However, we believe this to be comparable to a specific

industrial operation which generates a given wastestream and must

use representative samples for characterization. Therefore, our

pilot projects used the installations' Building Reduction Program

Plans for the current fiscal year (FY) to determine the next

group of buildings to be demolished. Some specific

problems that had to be addressed are detailed below.

(1) While most of the structures (e.g., the standard,

two-story WWII barracks) sampled were very similar in structure,

design, and paint color for a given installation, invariably

there were several "oddball" structures or perhaps two distinct

types of structures that made up some of the installation's

"waste population." The actual similarity between structures was

not considered a requirement in defining the population

since the buildings comprise one single overall wastestream --

each building contributing its own portion of lead. It was

noted, however, that the EPA had suggested that

buildings/structures that have had LBP removed

should not be included in a population of buildings with lead-

paint remaining, as this "may be considered "impermissible

dilution" (reference 14). The buildings sampled during this

study had not undergone paint-removal; furthermore, all were

either known or presumed to be painted with LBP.

(2) It was important to identify what portions of the

buildings were to be recycled or disposed of separately from the

general building debris. For instance, asbestos (transite)

siding identified on some structures was to be removed and

disposed of separately. Metal ductwork, furnaces, piping, and

siding was also to be removed as reusable/recyclable

scrap metal. It was also established whether the concrete

foundations of several buildings were to be demolished as well.

The components that were not to be included in the overall debris

(such as the metal constituents and asbestos siding) were not

considered part of the wastestream population. Appendix C

identifies the typical components that were established as part

of the wastestream populations.

b. Establishing the Sample Group. Once the population was

established, a percentage of the total number of buildings was

randomly selected as the sample group. The actual number of

buildings to be sampled was established using a statistical

approach based on EPA guidance (reference 15). To account for

the differences in some of the buildings (such as in structure or

paint color) a somewhat stratified random selection process was

used to select the buildings to be sampled. The protocol

indicates that buildings selected for the sampling group should

make up an "appropriate proportion." This meant that if 50

percent of the wastestream population was comprised of white

buildings and 50 percent were yellow, then this same ratio was

reflected in the sample group.

c. Composite Sampling.

(1) Each building in the sample group represented one

sample. The samples were each comprised of subsamples taken from

the various components that make up the individual buildings. In

total, each sample weighed approximately 100 grams, as required

for the TCLP. An electric drill was used to collect these

subsamples from components such as wood, plaster, drywall, and

foam. Hammerdrills were used to obtain samples from materials

such as brick, concrete, and cinderblock. The sample material

was collected onto large sheets of paper during the drilling

process and was then transferred to a sample bag. The number of

subsamples taken from each area was based on the proportion of

component material to the material comprising the entire building

(taking into account the required total mass of 100 grams). Due

to the particularly high lead concentrations found on

components such as windows, door frames, and doors, these items

were all included in the sampling process to ensure a

conservative (high) estimate of lead from the overall structure.

(2) The protocol describes how ratios between the

surface areas of the different components were used to establish

these proportions. As a result of drilling completely through

the components, the ratios were presumed to reflect volume-based

proportions. A volume-based ratio was used in the majority of

the pilot projects. (Appendix C provides three examples of

subsample distribution lists.) Since this approach focused on

"visible" surface areas -- the majority of which were painted --

there was a high degree of conservatism (i.e., the samples were

expected to reflect higher values of lead). However, this

approach was believed to be relatively cost-effective and

sufficient for the purposes of the study. A similar approach

(volume-ratio) for sampling buildings to be demolished was

established by a contractor for use at the Rocky Mountain Arsenal

(reference 16).

(3) While the EPA agreed with our approach, it was

inferred that the approach might be too conservative and that a

greater sampling effort would be justified if analytical results

were just above the regulatory threshold (RT) (reference 14).

The EPA also indicated that ratio by mass would probably be more

appropriate since the TCLP is based on the mass of a

sample rather than surface area or volume.

(4) We assumed that the mass-ratio approach would result

in lower lead concentrations than the volume-ratio approach due

to the heavier densities of materials such as concrete and brick.

This hypothesis was shown to be true when six buildings at Fort

McClellan were re-assessed after initial sampling results

revealed lead TCLP values of 6.2 mg/L to 15.8 mg/L. Mass-ratios

were determined using building schematics and standard densities

(reference 17). The resulting samples were less in volume, and

contained a higher percentage of concrete and brick than the

original samples. Analytical results were substantially lower

than before, with the highest concentration equal to 2.0 mg/L.

Appendix D contains the correspondence between the USAEHA and the

Alabama Department of Environmental Management regarding this

issue.

d. Laboratory Analyses and Quality Assurance/Quality Control

(QA/QC). Samples for all the pilot projects were analyzed by two

different USAEHA laboratories. Duplicates were randomly provided

to alternate laboratories for QA/QC purposes. The samples were

comprised of wood shavings, saw dust, pulverized brick and

concrete, and drywall "powder;" therefore, particle

size reduction was not necessary. After preparation, the samples

were analyzed in accordance with the procedures specified for the

TCLP (reference 1). These procedures included digestion of the

TCLP extract in accordance with EPA Methods 3010, 3015, or 3020

and analysis of the extract in accordance with either EPA Method

6010A or EPA Method 7421 (reference 18).

(1) The laboratories were instructed to "carefully mix

and homogenize each sample" before weighing out the exact 100

grams required by the TCLP. This mixing, along with the

minimization of excess sample while in the field, reduced the

problems associated with the settling of materials in the

sampling bag and provided better sample homogeneity.

(2) Duplicate samples were obtained by sampling randomly

chosen buildings twice. All duplicate samples indicated

acceptable levels of comparison. The arithmetic means of

duplicate samples were established as the data point values.

e. Data Evaluation. The analytical results for the

individual pilot projects were statistically evaluated using EPA

guidance (reference 19). This guidance indicates that the upper

80 percent confidence interval (CI) should be established and

compared to the RT. Since the statistical analysis is based on

the assumption of a normally distributed population, the guidance

also discusses procedures to "transform" the raw data if the

data does not show a normal distribution. The guidance states

that the mean for a normal distribution should be greater than

the squared standard deviation. This 'test' was applied to the

individual data sets to establish normality. By this definition,

none of the individual data sets had a normal distribution.

(This would indicate that the presence and/or concentration of

LBP is not consistent across the entire population of

buildings and was in fact "skewed" by occasional "hotspots.") As

per the EPA guidance, logarithmic or Poisson (square-root)

transformations were applied to the data sets to obtain normal

distributions. The transformed data presumably fits the

distribution pattern theorized by EPA in its guidelines for waste

characterizations (reference 19). The most appropriate

transformation (usually the Poisson) found for the data sets

was similarly applied to the RT of 5 mg/L. The upper 80 percent

CI of the transformed data was then compared to the similarly

transformed RT. Since none of the (transformed) upper 80 percent

CI's exceeded the (transformed) RT, the debris was consistently

characterized as nonhazardous. Based on recent comments from the

EPA (reference 14) and an independent evaluation of the EPA

statistical guidance, however, several problems have been

identified. While it does not appear that these issues will have

a significant impact on the conclusions of this study, they are

important in that they may impact future sampling efforts. These

issues are discussed below.

(1) The 'test' for normality as stated above is not

accurate. A normally-distributed data set may have a squared

standard deviation greater than the mean. However, through

graphing techniques we were able to show that the data sets were

in fact not normally distributed and that a more normal

distribution could be obtained through either a logarithmic or

Poisson transformation. Appendix E contains an example of this

graphical comparison.

(2) While transformations can be employed to yield a

more normal distribution model and therefore meet the model

assumptions, they do not necessarily do a better job of

"predicting" actual data distribution (or in this case, the 80

percent CI) (reference 20). In fact, the EPA has revealed

(reference 14) that they are working on a revisement of their

guidance and are now no longer recommending transforming data.

Though it is believed appropriate to follow published guidance,

data from the individual pilot projects has been evaluated and it

has been determined that the upper 80 percent CI calculated from

the raw (untransformed) data for the completed studies each also

falls below the RT of 5 mg/L.

(3) The normality of these individual data sets was

skewed by occasional "high" lead levels. These data points could

feasibly have been evaluated as "statistical outliers." As

outliers, they would have had to either be resampled or evaluated

separately. Due to the nature of this non-homogenous, highly

variable waste, however, all data points were retained for

statistical evaluation. By leaving these high values in the

data sets, the results are further biased to the conservative

side.

5. FINDINGS AND DISCUSSION. These findings address the specific

details of our study on Army WWII-era structures as well as

information regarding various other related issues. It should be

noted that these discussions assume that lead is the only

contaminant of concern. Several samples obtained for the pilot

projects were analyzed for other metals to include arsenic,

barium, cadmium, chromium, mercury, silver, and selenium. The

levels of these metal constituents was always found to be below

the associated RT. Other than these metal constituents no

additional parameters were evaluated.

a. Army WWII-Era Demolition Debris -- Pilot Projects. All

but one of the individual pilot studies has been completed. Each

of the completed studies has concluded that the debris should be

characterized as nonhazardous wastes (references 21-28).

b. Army WWII-Era Demolition Debris -- Overall. The data

accumulated during the pilot projects was combined and

statistically evaluated to assess the overall characteristics of

WWII-era demolition debris within the Army. The data from the

187 buildings is presented in Appendix F. Individually, the

majority of the buildings indicate TCLP lead concentrations well

below the regulatory threshold (RT) of 5 mg/L. Some of

the buildings showed TCLP values relatively close to the RT,

while a small few revealed comparatively high results (the

highest being 16 mg/L). A statistical evaluation of these data

points (also included in Appendix F) indicates that the overall

upper 80 percent CI is 3.5 mg/L. Since this is below the RT of 5

mg/L, the waste can be classified as a nonhazardous waste.

Though transformations of the data set are no longer being

recommended by the EPA (reference 14), a Poisson transformation

was performed in accordance with current published guidance

(reference 19). The resulting statistical evaluations also

revealed an upper 80 percent CI that was below the comparable RT

value.

c. Building Demolition Debris -- General. This aspect of

the study concentrated on structures that contained highly-leaded

paints, often on both exterior and interior surfaces. Due to

their age, several buildings had visible layers of paint. (On a

few buildings the layers were so thick they could be individually

peeled away). Presumably, these buildings represent "worst case

scenarios" with regards to lead concentrations. Newer buildings

will most likely contain less -- if any -- LBP. Also, the

buildings evaluated in the pilot projects were primarily

constructed of wood and drywall with some concrete foundation.

It may be assumed that buildings constructed primarily from

concrete or brick would contain a smaller proportion of paint by

mass to the mass of the overall structure, resulting in lower

lead concentrations. Therefore, the findings of this study may

be appropriate for all building demolition debris. In fact,

several states have independently classified such debris as

either nonhazardous waste or as a "special" waste (reference 8).

d. Waste Generated by Abatement, Renovation, Maintenance.

Several other LBP containing wastes were identified during this

study. These wastes are referred to as "small-scale debris" to

signify the differences with whole-scale building demolition

debris. The nature of these wastes results in a higher

proportion of paint to the overall wastestream; therefore, these

wastes are more likely to contain higher lead concentrations --

potentially exceeding the regulatory RT. Several different types

of small-scale debris are described in Appendix G along with

associated generating activities and suggested waste management

practices.

(1) The EPA has concluded (reference 29) that several

types of LBP abatement wastes are potentially hazardous wastes

and may need to be tested with the TCLP. Discussions with

"experts" to include paint removal contractors, paints and

coatings engineers, environmental coordinators, and facility

engineers (reference 30) have indicated that, in fact, the

majority of small-scale debris -- specifically where the paint

has been identified to contain appreciable amounts of lead --

exceeds the TCLP RT for lead and therefore must be classified as

hazardous waste. This information should be considered before

expending resources on sampling and analyses. For certain

wastestreams it may be more economical to classify

the waste as hazardous without performing the TCLP (see Appendix

G).

(2) Sampling methods for small scale debris should

follow the same principle used to sample entire buildings:

samples should be representative of the wastestream. Defining

the wastestream may involve preplanning and assessment to

determine appropriate segregation and handling procedures.

Additional information regarding sampling and wastestream

identification is contained in Appendix G.

(3) Preplanning and assessment may entail a

documentation of the task/operations to be performed and

identification of the presence and/or location of LBP as well as

identification of other potentially hazardous constituents such

as solvents/chemical strippers. If LBP is identified,

the TCLP can be performed to verify whether the waste is

hazardous or the waste can be immediately be assumed to be a HW.

Waste characterization information of chemical compounds may be

obtained through manufacturers [e.g., Material Safety Data Sheets

(MSDSs)] or through limited sampling.

(a) A variety of techniques can be employed to identify

LBP to include: (1) background/historical check (paints used

before 1978 are very likely to contain significant quantities of

lead), (2) chemical "spot" checks (inexpensive, commercially

available kits which provide a quick screen for the presence of

lead), (3) x-ray fluorescence (XRF) devices (an expensive yet

quantitative field screening method of identifying lead in

paint), and (4) Atomic Absorption Spectroscopy (AAS) laboratory

analysis (while more time consuming, costly and destructive than

other techniques, laboratory analysis will provide the most

accurate data). The method to use will depend on the type/scope

of the project. However, actual quantitative results (such as

from the XRF or AAS methods) will not necessarily correlate to

TCLP results for the wastestream (reference 31).

A qualitative result may, therefore, be more efficient for

assessing where LBP is present. For items where LBP is not

present, the waste from those items can be presumed to be

nonhazardous. Where LBP is expected (based on historical

records) or detected, the waste may be hazardous. Either this

waste can be disposed of as HW or a representative sample can be

tested with the TCLP. Testing with the TCLP in this case would

only be recommended if large quantities of waste were involved.

(b) In cases where certain components of a project's

wastestream may individually be hazardous (such as painted wood

siding) while others are nonhazardous (drywall, wood framework,

and concrete), a waste management scheme can be documented to

ensure proper segregation, HW minimization, and waste

handling/storage/transport/and disposal. When segregation of the

components is not feasible given the scope of the project, all

waste must be characterized (with the TCLP) together,

resulting in either a single nonhazardous wastestream or a single

hazardous wastestream.

e. Environmental Concerns and Best Management Practices

(BMPs). Characterizing demolition debris as nonhazardous waste

does not mean that the operations generating such debris should

disregard other environmental issues. Though these activities

are not always regulated, imprudent procedures could result in

future liabilities. The planning, contracts, and SOPs associated

with demolition actions should address the following issues.

(1) Soil Contamination and Future Use. After removal of

debris from a demolition site, it may be necessary to sample and

analyze soil to assess potential health hazards associated with

the future use of the site. This is especially a concern if the

future use of the site exposes children to the soil (e.g., a

playground). Current EPA guidance (reference 32) indicates that

levels between 500 and 1,000 ppm are protective of human

health. Other soil lead levels have been established by various

states. Appendix H lists current regulatory soil-lead cleanup

levels. Levels exceeding these concentrations may have to be

removed, characterized, and properly disposed or treated.

(2) Storm Water Runoff. While demolition actions are not

typically regulated under the EPA's Storm Water Program, some of

the Best Management Practices (BMPs) described in EPA Storm Water

Management guidance (reference 33) have direct application to

such activities. Following some of these suggested practices

could help minimize environmental impacts and potential safety

hazards associated with demolition actions. Excerpts from

the EPA guidance are contained in Appendix I.

(3) Dust Control. Dust control is primarily a concern

for worker safety and the exposed public. Currently, there are

no Federal regulations requiring emissions controls for

demolition activities. However, as a BMP, activities that occur

in areas that have public access should ensure to the extent

possible that dust is minimized or controlled. The BMPs

discussed above provide some methods of dust control. Also, air-

monitoring for lead concentrations may be useful to evaluate the

extent of exposure to workers. New lead action limits (50

\_g/cubic meter) have been set for specific construction industry

tasks (e.g., manual demolition) (reference 34). Workers at

demolition sites or other dust-generating activities

(particularly those who are continuously employed in these

operations) may be advised to wear dust masks or other protective

gear if LBP is present/suspected.

f. Disposal Options and Alternatives.

(1) Nonhazardous Waste. During this study, it was

determined that -- once characterized as a nonhazardous waste --

the debris from the individual pilot project studies would be

disposed of in C/D debris landfills. While this is an

appropriate form of disposal, other options may prove to be more

beneficial/environmentally acceptable. The burden of this large

volume of waste on the diminishing supply of available landfill

space cannot be over-emphasized (reference 8). Due to new

requirements for C/D debris landfills (e.g., location

restrictions, monitoring requirements) generators may find it

increasingly difficult/expensive to choose this method of

disposal. Appendix J contains a table of alternatives/options to

landfilling along with the associated benefits and disadvantages

of each. Installations should consider these options and assess

the applicability of each based on site-specific conditions.

(2) Hazardous Waste.

(a) Waste identified as hazardous (e.g., small-scale

debris) must be treated and disposed of in accordance with RCRA.

Current regulations (references 35 and 36) require that lead-

contaminated waste must be treated before land disposal in a

hazardous waste landfill. The treatment methods identified for

this type of waste include microencapsulation,

microencapsulation, and stabilization. A common treatment

technology involves grinding and mixing into a cement slurry.

Other than land-disposal, hazardous waste may be incinerated in

an appropriate RCRA-permitted facility.

(b) Debris characterized as hazardous can also be

reassessed for purposes of segregation and separation/removal.

For example, waste from a renovation project (to include drywall,

wood, concrete, and brick) may (overall) be classified as an HW.

However, if only drywall and small quantities of wood are

painted, these components could be separated out for HW disposal

while the remaining waste (wood, concrete, and brick) could be

disposed of as a nonhazardous waste. Similarly, paint-removal

procedures (such as abrasive blasting) could be employed to

render the substrate (e.g., wood) nonhazardous therefore greatly

reducing the volume of HW. The cost benefits of reducing the

volume of HW must be balanced with the costs associated with

waste segregation, separation, and/or removal.

(3) Recycling. As mentioned early in this report, metal

items such as duct work, piping, aluminum siding, and furnaces

were designated as recyclable materials (scrap metal) and not

included in the composite samples. Other materials such as

porcelain (bathroom fixtures) and glass (windows and mirrors)

were other commonly found items that were identified as

recyclable/reusable and therefore not sampled. Items such as

these for which there are available markets and which can

feasibly be retrieved with minimal cost should be segregated to

the extent possible. Recycling opportunities may also exist for

other items such as wood flooring, concrete, or brick. However,

while recycling these materials will reduce the overall volume of

waste and may even result in financial returns, it may also mean

that a previously nonhazardous wastestream is now hazardous.

Recycling may prove beneficial only when the returns outweigh the

costs associated segregation and disposal of the remaining

(hazardous) waste.

6. CONCLUSIONS.

a. Building Demolition Debris. Whole-building demolition

debris -- specifically WWII Army structures -- can be

characterized as a nonhazardous waste based on the findings of

this study. Since this study focused on the characteristics of

Army WWII structures which are known to be heavily painted with

LBP, it may be construed that other structures undergoing

demolition are also nonhazardous. It is important to note,

however, that these conclusions are in accordance with FEDERAL

regulations and the assumption that such waste must be tested in

accordance with RCRA (TCLP) requirements. Some states and EPA

regions have independently classified such debris as nonhazardous

waste or as "special waste;" other states have more stringent

approaches. However, even though such debris may not be

regulated as a hazardous waste, certain handling/management

procedures are recommended.

(1) As discussed previously, the definition of

wastestream population and whole-building demolition debris that

was applied during this study included the majority of the

building structural components, to include wood floors and cement

foundations/footers. For demolition projects that involve

recycling/reuse of a significant structural component

(such as the concrete foundations), a limited sampling effort may

be used to determine whether the debris still meets the criteria

of a nonhazardous waste. The procedures described in the

protocol -- with the exception of statistical transformations --

are currently recommended.

(2) For certain structures, additional parameters or

contaminants of concern may be identified. Lead and other metal

constituents contained in paints and pigments were the only

identified contaminants in this study. The conclusions of this

study, therefore, are not necessarily valid for buildings which

contain contamination from other sources. The sampling

procedures used in this study, however, may be an appropriate

approach to assess other parameters.

b. Other LBP-Contaminated Waste Items. The larger the

proportion of lead-paint to the overall wastestream, the greater

the likelihood that the waste will be hazardous. Sampling and

analysis costs can be minimized by using generator knowledge to

characterize many of these wastes.

(1) Generator-knowledge can often be used to determine

if a waste is hazardous. Knowledge obtained from previous

sampling, XRF readings, MSDSs or other manufacturers information,

or the information contained within this report may be used to

minimize or eliminate sampling when characterizing a waste as

hazardous. While using generator knowledge to characterize

wastes as non-hazardous is also permissible, limited sampling

is advised since small-scale debris is most frequently hazardous.

(2) Small-scale debris wastes should be identified

and/or characterized before generating activities occur to ensure

that proper segregation, handling, packaging, transport, and

disposal procedures are followed. Also, early assessment will

provide necessary funding information and contract arrangements.

c. Environmental Concerns and BMPs. Environmental concerns

relating to the demolition of buildings containing LBP or

management of debris containing LBP involve potential

contamination of soil, surface water, and air. Though there are

few regulations currently governing the control of lead-releases

from these operations, certain precautions and BMPs (as

described in paragraph 5e) are advised to minimize potential

environmental and health threats.

d. Disposal Options and Alternatives.

(1) Nonhazardous Waste. While disposal in a C/D debris

landfill may be appropriate and relatively inexpensive at this

time, generators should consider other options that offer more

than an "out-of-sight, out-of-mind" solution. Each of these

options, as discussed above, has both benefits and disadvantages.

State and/or local regulatory involvement will be necessary when

assessing the feasibility of such alternatives.

(2) Hazardous Waste. The volume of LBP-related HW

should be minimized to the extent most feasibly and economically

possible. This can be done through careful assessment of

operations and segregation of wastestreams as well as separation

of contaminated items or removal of LBP.

(3) Recycling. Many items such as metal duct work,

piping, and siding can be salvaged from buildings that are to be

demolished for recycling/reuse. Recycling can provide economic

gains in addition to the environmental benefits associated with a

reduced wastestream.

7. RECOMMENDATIONS.

a. Identify whole-building demolition debris wastestream

populations that meet the descriptions discussed in this report.

b. Characterize such waste as nonhazardous, pending

concurrence from state and local agencies.

c. Identify other sources of lead-paint containing waste and

debris. Determine appropriate waste segregation and management

procedures based on cost-analyses and findings discussed above.

d. Evaluate the potential for environmental media (e.g.,

soil) contamination at demolition sites, specifically with

regards to future-use scenarios and human health-risk.

e. Develop SOPs for demolition site operations to minimize

environmental contamination and health hazards.

f. Assess current disposal procedures for demolition debris.

Correct deficiencies/make amendments to contracts and/or SOPs

with regard to final destination, liabilities, and control.

g. Evaluate disposal options and alternatives with regards

to environmental and other regulatory requirements, cost, and

other benefits/disadvantages as discussed above.

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APPENDIX A

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APPENDIX B

USAEHA SAMPLING PROTOCOL

SAMPLING PROTOCOL

FOR

BUILDING DEMOLITION DEBRIS

AND

BUILDINGS PAINTED WITH LEAD-BASED PAINT

1. REFERENCES. Appendix A contains a list of the materials

referenced in this document.

2. PURPOSE. The procedures outlined in this protocol provide a

method of characterization for the solid waste generated during

demolition operations through sampling and Toxicity

Characteristic Leaching Procedure (TCLP) analyses.

3. BACKGROUND.

a. Since May 1991 (reference 1), problems associated with

disposal of construction debris have surfaced at various Army

installations. More specifically, these concerns have focused on

problems associated with lead-based paint "contaminated" debris

from the demolition of World War II era-buildings and other

structures known to be contaminated with lead paint. Appropriate

sampling and analytical techniques have not been easily defined

due to the lack of specific regulatory guidance.

b. A proposed rule, published in the 17 January 1992 Federal

Register (FR) (reference 2), cited requirements to test building

debris for suspected metal constituents using the TCLP. The

proposed rule indicated that a "homogenous" sample,

representative of the building, should be obtained from any

building scheduled to be demolished. The proposed rule explained

that representative proportions of the various building materials

(to include glass, wood, cement, brick, roofing material, and any

metal piping, utilities, or equipment that will remain in the

building at the time of demolition) should be included in the

homogenized sample.

c. The final rule, published in the 18 August 1992 FR

(reference 3), cited no significant changes. In addition,

certain states and even regional U.S. Environmental Protection

Agency (EPA) offices have requested that this type of solid waste

(i.e., demolition debris) be adequately characterized (references

4-6). Due to the increasing number of installations requesting

characterization assistance and the initial feedback from EPA

officials (references 7 and 8), a decision was made between

various Army agencies (reference 9) to establish a feasible,

standardized plan for demolition debris characterization. The

plan would outline the appropriate sampling and analytical

procedures to be used by Army installations/activities whenever a

demolition debris characterization is needed.

d. The U.S. Army Environmental Hygiene Agency (USAEHA) has

developed this generic sampling protocol to assist Army

installations/activities in efficiently satisfying the

requirements of the new EPA rule in accordance with existing EPA

methodologies and guidelines (references 10 and 11). The general

approach of this protocol has been verbally approved by the EPA

(reference 12). By consistently using this approach, the USAEHA

hopes to establish an Army-wide hazardous waste characterization

baseline for various types of buildings and structures. The

baseline may eventually be used to minimize or eliminate the need

for additional sampling and analyses.

e. The USAEHA has been promoting this plan through initial

sampling studies (pilot projects) at selected installations.

These installations were selected based on the need for immediate

waste characterization, the quantity of projected (FY 92)

demolition debris, geographic location, and major Army command

(MACOM). Appendix B contains brief descriptions of the selected

installations and initial findings.

4. SCOPE.

a. Before characterizing the waste, it is necessary to

define the wastestream. This protocol defines the wastestream or

"population" that is being characterized as the debris generated

during a given demolition project at a given site/installation.

Demolition projects are typically designated by a given FY;

therefore, an installation should have one demolition wastestream

generated each year. While all buildings/structures being

demolished in a given year constitute the population, only a

percentage of these buildings should be sampled. More details on

how to determine the appropriate number of buildings to sample

are presented in the "PROCEDURE n section below.

b. This protocol and the associated pilot projects are

designed to characterize demolition debris from entire buildings.

A previous study (reference 13) has shown that certain

constituents may appear in more concentrated forms when

individual components of buildings are tested. "Small-scale"

demolition/construction debris that is generated during

maintenance, removal, or other structural modification projects

should be individually tested and characterized. In general, this

"small-scale" debris should include any demolition/ construction

debris that does not involve the entire building. Appendix C

contains a brief discussion on disposal procedures for "small-

scale" debris.

5. PROCEDURE. During a demolition debris waste characterization

study, several site-specific determinations will need to be made.

The following steps are detailed to the extent possible.

a. Defining Individual Wastestreams/Populations. As defined

above, the wastestream/population will consist of all the debris

generated during a specified demolition project. A list of the

buildings should include notations of buildings that are

identical. Information should also be gathered regarding the

demolition and disposal procedures. For instance, if the

structures are set on cement foundations it would be necessary to

determine whether the cement is to be demolished and disposed of

with the rest of the debris. If such foundations were to be left

in place they would not be considered as debris; otherwise, they

would be included in the wastestream and would be sampled in

accordance with the procedures discussed below.

b. Determining the Number of Samples. Based on EPA guidance

(reference 10), a statistical approach will be used to determine

the number of buildings that need to be sampled. This approach is

based on the assumption that the buildings are all of a

relatively unique population and that the analytical results of

the study will be normally distributed. The EPA manual SW-846 -

Test Methods for Evaluating Solid Wastes (reference 11), requires

that the number of samples and statistical parameters used to

characterize a 'population' ensure an 80 percent confidence level

in the resulting determination (in this case, hazardous or

nonhazardous). The Table is based on these guidelines and should

be used to determine the number of buildings to be sampled in a

given population:

c. Sample Buildings Selection. Once the number of buildings

to be sampled has been determined, the specific buildings to be

sampled need to be identified. A somewhat random approach should

be used in the selection process. Buildings may be randomly

selected using building numbers or placement on maps. However,

when one or more groups of identical buildings (e.g., a set of

WWII barracks, all painted the same, maintained the same, etc.)

constitutes a portion of the population, an appropriate

percentage of buildings should be selected from the individual

group(s).

d. Samplinq Strategy. The objective is to obtain one

composite sample from each selected sample building. The

composite sample should include appropriate proportions of all

materials constituted within the structure. The Figure depicts

various areas of a building that may be constructed of different

materials and should be sampled.

(1) Building components, such as glass, screen, or

wiring, that are difficult to sample and comprise a very small

percentage of the overall structure, will not be sampled. Also,

materials such as aluminum siding, large metal ductwork, light

ballasts, utility equipment, and asbestos insulation should not

be sampled as these materials should be separated from the

demolition debris and disposed of separately or recycled/reused

(e.g., scrap metal). In general, the most commonly sampled

components will be wood, brick, cement and plaster/wallboard.

(2) The proportional size of the various building

areas based on (estimated) square footage must be determined. For

instance, a building may be 70 feet long, 40 feet wide and 12

feet high; if all four of the exterior walls are made of the same

material, there is 2,640 ft2 of that material/component. Window

and door space should be subtracted out from the

exterior/interior walls and considered as separate areas. The

total estimated areas of the individual areas (e.g., exterior

wall, interior plaster board wall, interior plywood/panelling

wall, floor, cinder block supports, etc.) should be compared to

one another in order to establish ratios. The ratios will

determine the number of subsamples to obtain from each individual

area. Generally, 20 to 30 subsamples are necessary to makeup one

110-gram sample. This number will vary based on the types of

materials in the building.

TABLE. STATISTICAL DETERMINATION OF THE NUMBER OF BUILDINGS TO

BE SAMPLED

NO. OF TOTAL BUILDINGS NO. OF BUILDINGS TO SAMPLE\*

1 - 9 ALL

11 - 15 10

16 - 20 13

21 - 30 16

31 - 40 21

41 - 100 26

> 100 32

\* These numbers are designed to meet or exceed the statistical

requirements set by EPA. Both the power and the confidence

intervals (CI's) were set at or above 90 percent and 80 percent,

respectively, and the precision was established as 20 percent.

The coefficient of variance (CV) is assumed to be 35 percent. The

actual CV will vary from case to case and should be determined

when the analytical results are available. A complete statistical

evaluation of the analytical data will involve a calculation of

the actual CV and potentially include data transformations and/or

adjustments to the other statistical parameters (see the "DATA

ANALYSES" section below).

Figure

Example Diagram of a Building

(WWII Temporary Barracks Slated for Demolition)

Not Available Online

e. Sampling Methodology.

(1) Using a 1-inch bit drill or similar device, a "core"

subsample should be obtained from the selected areas of the

building. The subsample material should be collected into a

disposable container (such as large sheets of paper) as the

drilling is done. The sampling crew should -- to the extent

feasibly possible -- drill through the entire substrate. For

building components such as cinder block or cement a hammer drill

should be used. The number of drill holes obtained from each type

of surface/area should be recorded. If the amount of overall

sample material is not enough (i.e., less than 110 grams) for the

TCLP, additional subsamples should be obtained from each of the

specific areas. [NOTE: For at least 5 percent of the samples (and

a minimum of 1 sample), approximately 300 grams should be

obtained for adequate split laboratory analyses.]

(2) Field duplicates, equaling 5 percent of the number

of actual samples (at a minimum of one), should be obtained to

check the sampling practice. The duplicate(s) should be obtained

by simultaneously filling two sample containers during the sample

process (i.e., for each subsample within a sample building, two

adjacent cores should be obtained and placed into two separate

containers).

f. Collection and Labelling. The sample material from each

building should be collected onto a (disposable) container (such

as sheets of unused paper, paper plates, etc.). From this

collection container, the materials should be emptied into clean

(new) plastic baggies and labelled with the project/installation

name and or identification number, sample (building) number,

sample date, and sampling personnel's name.

g. Decontamination. Nondedicated sampling equipment such as

the drill bit should be decontaminated between sampling of

individual buildings. The sampling crew should first brush excess

material from the equipment and then wash using tap water and

soap. This should be followed by a final rinse with distilled,

deionized, filtered (DDIF) water. To ensure the equipment was

properly decontaminated, a used rinse water sample should be

taken and analyzed.

6. LABORATORY ANALYSES.

a. Packaginq and Transportation. All samples should be

properly packaged before transporting them to the certified

analytical laboratory.

b. Laboratory Preparation. To ensure thorough mixing of

the material, the laboratory should be requested to thoroughly

mix/homogenize the sample material before preparing it for

analyses. This will minimize the 'settling' that may occur

during transportation. This procedure is extremely important

when excess sample has been obtained and the laboratory will only

be using a portion of the overall sample.

c. Analytical Methodology. All solid (wood/plaster/

paintchip, etc.) samples should be extracted using EPA Method

1311 (TCLP). The samples should be analyzed using either EPA

Method 6010A [Inductively Coupled Plasma (ICP)-Atomic Emission

Spectroscopy] or EPA Method 7421, the Atomic Absorption, Furnace

Technique for lead. The ICP procedure is recommended due to

lower cost, but either method will satisfy EPA requirements

(reference 14). The rinsate sample should also be analyzed using

one of these methods.

7. DATA ANALYSES.

a. The TCLP laboratory results should be statistically

analyzed to assess the variability among the structures and

overall normality of the lead distribution. If the analytical

results do not indicate a normal distribution (i.e., the

arithmetic mean is not greater than the variance), the raw data

should be transformed (reference 11). After normality has been

achieved through an appropriate transformation, the 80 percent CI

should be calculated and compared to the (similarly transformed)

regulatory threshold (RT) of 5.0 mg/L of lead (reference 11).

b. Additional procedures may be necessary to address

potential "statistical outliers," or buildings that yield

unusually high TCLP lead concentrations that dramatically skew

the 80 percent CI. If necessary, such buildings may be addressed

as a separate population.

8. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC). The QA/QC

measures for this sampling effort includes the field

duplicate(s), rinsate sample, and laboratory duplicate(s). These

measures are all in accordance with EPA guidance (reference 10).

9. SITE SAFETY PROCEDURES. A Site Safety and Health Plan (SSHP)

must be established to ensure safe working conditions for

personnel performing the procedures outlined in this protocol. An

SSHP summarizes the potential hazards and safety procedures

during sample collection at the subject buildings. Appendix D

includes an example of an SSHP.

10. COORDINATION AND MONITORING. Analytical results obtained

using this protocol or a similar approach are being requested for

placement in a database. Future sampling of building demolition

debris may be minimized or even eliminated based on such results.

Personnel using this protocol may direct any questions, comments,

or results to Ms. Veronique Hauschild of the Waste Disposal

Engineering Division, USAEHA, at DSN 584-2953, commercial (410)

671-2953, or forward same to the address below:

COMMANDER

USAEHA

ATTN: HSHB-ME-SH (V.Hauschild)

BLDG 1677

APG - EA, MD 21010-5422

APPENDIX A

REFERENCES

1. Memorandum, FORSCOM, FCEN-CED-E, 17 May 1991, subject:

Disposal of Waste Construction Debris Containing LeadContaminated

Paint.

2. Proposed Rule, Land Disposal Restrictions for Newly Listed

Wastes and Contaminated Debris, 57 Federal Register 958, 9

January 1992.

3. Final Rule, Land Disposal Restrictions for Newly Listed

Wastes and Hazardous Debris, 57 Federal Register 37194, 18 August

1992.

4. Memorandum, AFZD-DEQ, 10 May 1991, subject: Lead Paint

Compliance Strategy [re: State of Massachusetts and EPA Region

Stance on Waste Characterization.

5. Letter, State of Maryland Department of the Environment, 23

December 1991, re: Characterization of Lead-Based Paint Debris

(at Aberdeen Proving Ground).

6. Letter, Alabama Department of Environmental Management, 8 May

1992, re: Demolition of Buildings Painted with Lead-Based Paint

(at Fort McClellan).

7. Telephone conversation between Ms. Elaine Ebeye, Treatment

and Technologies Branch - Office of Solid Waste (OSW), EPA, and

Ms. V. Hauschild, U.S. Army Environmental Hygiene Agency

(USAEHA), January 1992.

8. Telephone conversation between Mr. Jim Thompson, Enforcement

Division, EPA, and Ms. V. Hauschild, USAEHA, January 1992.

9. Memorandum, ENVR-EH, 22 May 1992, subject: Analysis and

Disposal of Construction Debris (Army Environmental Office

requesting assistance from USATHAMA and USAEHA).

10. EPA/600/8-89/046, March 1989, Soil Sampling Quality

Assurance User's Guide, 2nd Edition.

11. EPA Manual SW-846, November 1986, Test Methods for

Evaluating Solid Waste (Volume II), 3rd Edition.

12. Telephone conversation between Mr. Dave Topping, OSW, and

Ms. V. Hauschild, USAEHA, 28 August 1992.

13. Memorandum, USAEHA, HSHL-ME-SH, 27 March 1992,

subject: Hazardous Waste Study No. 37-26-J105-91,

Characterization of Demolition Debris Containing

Lead-Lased Paint.

14. EPA Manual SW-846, Revision 1 November 1990, Test Methods

for Evaluating Solid Waste, (Volume I, Part A), 3rd Edition.

APPENDIX B

PILOT STUDIES

The following installations make up the current list

(September 1992) of USAEHA pilot studies for demolition debris

waste characterization. A brief summary of the status of the

individual cases is provided. The associated reports/memorandums

that are referenced where available. Copies of these documents

can be obtained through the Waste Disposal Engineering Division

of USAEHA.

Fort Devens, Massachusetts

With over 200 WWII barracks to demolish and stringent state

requirements, Fort Devens was the first installation to identify

the problem. A study performed by USAEHA (see reference 13 in

Appendix A of this protocol) revealed concentrations of lead

statistically higher than the regulatory threshold (RT). However,

the report indicated that a more appropriate sampling procedure

was necessary, as the actual wastestream incorporated the entire

building and not just the painted portions. The installation has

obtained a contractor and is recharacterizing the buildings using

the USAEHA recommended approach.

Aberdeen Proving Ground (APG), Maryland

After receiving conflicting statements from two different state

regulatory officials, APG determined that a conservative approach

was necessary and opted to test the buildings. The APG requested

USAEHA to assist with sampling and analysis. Initial results have

revealed that the majority of the buildings pass the TCLP test

(i.e., contain less than 5 mg/L lead). A memorandum to the

installation is expected to be finalized in September 1992.

Fort Knox, Kentucky

After receiving the USAEHA Draft Protocol for Sampling Demolition

Debris, installation personnel collected and had samples

analyzed accordingly. The raw data was sent to USAEHA for

statistical evaluation. Out of approximately 100 buildings that

were to be demolished, 54 were sampled. Six samples failed the

TCLP analysis (i.e., results exceeded 5 mg/L lead) but the

statistical evaluation indicated that the actual wastestream

(i.e., demolition debris as a whole) did not exhibit the

hazardous characteristic for lead. The resulting memorandum is

provided in the Annex.

Fort McClellan, Alabama

Laboratory results indicating high levels of lead and cadmium

in paint samples were provided to the State of Alabama in a

request for disposal options for demolition debris. The state

denied the request to dispose of such waste in a sanitary

landfill (reference 6, Appendix A of this protocol). The initial

results of a USAEHA sampling study indicate that representative

samples of the buildings do not contain significant

concentrations of cadmium. Lead was present in most samples, but

exceeded the RT in only a few samples. A memorandum documenting

the findings is expected to be completed in October 1992.

Fort Meade, Maryland

Though in the same state as APG, this installation was able to

get clearance from the state to dispose of building debris in a

Subtitle D (nonhazardous waste) landfill. However, due to the

convenient location and ready supply of buildings, USAEHA

personnel were able to obtain several samples. These samples are

currently being analyzed by the USAEHA laboratory. The findings

will be documented in a final report expecl;ed to be released in

early 1993.

Fort Riley, Kansas

Timelines for this project are being developed. Sampling

activities are expected to take place in October 1992.

Fort Jackson, South Carolina

Timelines for this project are being developed. Sampling-

activities are expected to be completed within the first quarter

of FY 93.

Fort McCoy, Wisconsin

Timelines for this project are being developed. No sampling

dates are available at this time.

DEPARTMENT OF THE ARMY

U.S. Army Environmental Hygiene Agency

Aberdeen Proving Ground, Maryland 21010-5422

HSHB-ME-SH (40)

Annex -9 SEP 1992

MEMORANDUM FOR Commander, U.S. Army Armor Center and School and

Fort Knox, Directorate of Engineering and

Housing (ATTN: Mr. Louis Barnhart), Fort Knox,

KY 40121

SUBJECT: Lead Testing of Demolition Buildings

l. REFERENCES.

a. Telephone conversation between Mr. L. Barnhart, Fort Knox,

and Ms. V. Hauschild, this Agency, 25 August 1992, SAB.

b. AEHA (Draft) Protocol: Sampling of Buildings to Be

Demolished.

c. EPA Manual SW-846, November 1986, Test Methods for

Evaluating Solid Waste (Volume II), 3rd Edition.

d. Ott, Lyman; An Introduction to Statistical Methods and

Data Analysis (page 418), PWS-Xent Publishing Company, 1992.

e. EPA 600/8-89-046, March 1989, Soil Sampling Quality

Assurance User's Guide, 2nd Edition.

2. This memorandum is in response to your request (reference 1a)

that our Agency review the lead Toxicity Characteristic Leaching

Procedure (TCLP) data obtained from 54 buildings that are to be

demolished. At the time of the request, details of the sampling

and analytical procedures were confirmed to be appropriate and in

accordance with the basic draft protocol being used by our Agency

(reference 1b). This protocol has been verbally accepted by the

Office of Solid Waste, Headquarters U.S. Environmental Protection

Agency.

3. The raw data was analyzed using appropriate statistical

procedures in accordance with EPA guidance (reference 1c). Where

duplicate samples were analyzed, the arithmetic mean was used

instead of the two samples. The results of this statistical

evaluation are enclosed.

4. The goal of the statistical calculations was to determine the

80% confidence interval (CI). The upper limit of the 80% CI is

to be compared with the applicable regulatory threshold (RT) to

determine if the solid waste contains the contaminant of concern

at a hazardous level (reference lc). Since this statistical

evaluation is based on the assumption of a normal distribution,

the data was first transformed in accordance with proper

statistical procedures (reference lc and ld). A normal

distribution was achieved through a Poisson (square-root)

transformation.

5. The transformed upper 80% CI for this wastestream falls below

the (transformed) RT for TCLP lead, resulting in a non-hazardous

waste. The wastestream can be defined as all demolition debris

being generated during a given FY demolition action. This would

include the other 4S buildings at Fort Knox that have not been

sampled. In accordance with EPA guidance (reference le), an

adequate number of samples (i.e., buildings) has been sampled to

characterize the wastestream population.

6. Future sampling of building demolition debris may be minimized

or even eliminated based on these results and similar studies

being performed at other Army installations. Questions concerning

this matter should be directed to Ms. Veronique Hauschild at DSN

584-3651 or commercial (410) 671-3651.

FOR THE COMMANDER:

Signed

Encl JOHN J. RESTA, P.E.

Program Manager

Hazardous and Medical Waste

Waste Disposal Engineering Division

FT KNOX RESULTS: LEAD TESTING OF DEMOLITION BUILDING

Pb TCLP log Pb SQRT Pb STATISTICAL EVALUATIONS

(mg/L)

1 3.07 0.487138 1.752141

2 2.34 0.369215 1.529705 3.231 MEAN

3 4.29 0.632457 2.071231 3.112 STD Mean < STD2

4 0.71 -0.14874 0.842614 0.057 Std Error

5 6.86 0.836324 2.619160

6 4.62 0.664641 2.149418 3.305 80% CI

7 3.26 0.513217 1.805547

8 1.44 0.158362 1.2 5.0 RT 80% CI < RT

9 1.91 0.281033 1.382027

10 0.09 -1.04575 0.3

11 4.76 0.677606 2.181742 Trnsfrmd (LOG)

12 4.13 0.615950 2.032240 Statistics

13 1.18 0.071882 1.086278

14 4.58 0.660865 2.140093 0.296 Mean

15 7.6 0.880813 2.756809 0.500 STD Mean < STD2

16 4.16 0.619093 2.039607 0.068 Std Error

17 9.55 0.980003 3.090307

18 3.24 0.510545 1.8 0.384 80% CI

19 3.03 0.481442 1.740689

20 4.02 0.604226 2.004993 0.699 RT 80% CI < RT

21 2.64 0.421603 1.624807

22 1.84 0.264817 1.356465

23 5.36 0.729164 2.315167 Trnsfrmd (SQRT)

24 1.99 0.298853 1.410673 Statistics

25 16.8 1.225309 4.098780

26 0.15 -0.82390 0.387298 1.589 Mean

27 3.92 0.593286 1.979898 0.805 STD Mean > STD2 \*\*\*

28 0.17 -0.76955 0.412310 0.110 Std Error

29 0.11 -0.95860 0.331662

30 1.78 0.250420 1.334166 1.731 80% CI

31 7.42 0.870403 2.723967

32 3.03 0.481442 1.740689 2.236 RT 80% CI < RT

33 0.7 -0.15490 0.836660

34 0.71 -0.14874 0.842614

35 3.58 0.553883 1.892088

36 3.13 0.495544 1.769180

37 2.92 0.465382 1.708800

38 1.24 0.093421 1.113552

39 2.79 0.445604 1.670329

40 2.74 0.437750 1.655294

41 1.96 0.292256 1.4

42 1.8 0.255272 1.341640

43 0.43 -0.36653 0.655743

44 0.9 -0.04575 0.948683

45 3.97 0.598790 1.992485

46 0.23 -0.63827 0.479583

47 3.29 0.517195 1.813835

48 0.92 -0.03621 0.959166

49 1.71 0.232996 1.307669

50 2.28 0.357934 1.509966

51 0.47 -0.32790 0.685565

52 0.55 -0.25963 0.741619

53 13.47 1.129367 3.670149

54 4.61 0.663700 2.147091

APPENDIX C

SMALL SCALE

LEAD-BASED PAINT DEBRIS

SUGGESTED GUIDELINES FOR

WASTE CHARACTERIZATION AND DISPOSAL

DEFINITION: "Small scale" lead-based paint debris includes

building/structural debris generated during renovation,

maintenance, or abatement of structures that are painted with

lead-based paint. This debris may be comprised of a variety of

materials such as wood, plasterboard, drywall, brick and/or

cement, or may only involve a specific item such as wood doors or

window frames/sills.

SCOPE: This document does not address safety and health

requirements for personnel or building inhabitants nor does it

describe abatement/encapsulation procedures and/or requirements.

These are generic guidelines to assist installations when

determining the most efficient means for characterizing and

disposing of the waste debris.

OTHER RBFERENCES: Several other documents, guides, and even

policies that address the other aspects of the lead-based paint

issue (assessment of housing, abatement, blood-level monitoring,

worker protection, etc.) are being fonmulated at this time (e.g.,

DOD Commander~s Guide to Lead-Based Paint Issues and the DOD

Technical Guide to Lead-Based Paint Issues). The HUD Interim

Guidelines for Hazard Identification and Abatement in Public and

Indian Housing is also a good source for additional information.

Unfortunately, these sources do not address waste

characterization with adequate detail.

PROCEDURES: The following procedures are written as a set of n

suggested steps n that installation personnel should use to most

efficiently identify, characterize, and dispose of small scale

lead-based paint debris.

1. The first step is the identification process.

Installations need to determine if and where lead-based paint

exists. While many installations are currently faced with

immediate identification problems, an installation assessment may

eventually facilitate proper handling and disposal actions, thus

reducing costs and improving efficiency.

a. In the meantime, all buildings undergoing maintenance,

renovation or abatement should be assessed for the possibility

for containing lead-based paint. This initial "assessment" can

be performed without the use of any equipment such as x-ray

fluorescence (XRF) analyzers or chemical analysis.

Knowledge of the approximate age of the building (buildings built

prior to 1978 are more likely to contain lead-based paint), which

areas are going to actually be removed and disposed (exterior

painted surfaces, window frames and doors are areas that often

contain the most concentrated forms of lead-based paint), and the

results of any previously sampled debris, should provide an

assessor with enough information to determine whether lead may be

present.

b. While many "lead kits" and XRF analyzers are now

available for assessing lead presence in paint, these

technologies were designed to evaluate the total amount of lead

in the paint, rather than the amount of leachable lead. It is

this leachable concentration [achievable through the Toxicity

Characteristic Leachate Procedure (TCLP)] which must be used to

characterize the waste. A comparison of the results from a

spectrum XRF analyzer and the associated TCLP values revealed no

correlation (see reference 13, Appendix A of this protocol).

APPENDIX C

BUILDING COMPONENTS: SAMPLING LOCATIONS

(excerpts from field sampling logs)

EXAMPLE I

No.

Sub-Samples Location

6 exterior walls

1 outside windows

1 (concrete) foundation

1 trim - outside

4 interior floor

4 ceiling

2 interior wood components (door frames/window sills)

5 drywall

3 plywood (interior)

27 TOTAL

EXAMPLE II

No. Sub-Samples Location

5 exterior walls

4 ceiling

3 floor

2 concrete flooring

2 sheetrock

2 interior wood components (doorframe, window)

2 exterior wood trim (door, window frames)

4 drywall

4 plywood

24 TOTAL

EXAMPLE III

No. Sub-Samples Location

5 exterior walls

3 floors

3 ceiling

1 concrete footers

4 drywall

2 plywood

4 int. wood components (doorfrarne,windows,wall,pillar)

2 exterior wood trim (door, window frames)

1 chimney (brick

25 TOTAL

APPENDIX D

CORRESPONDENCE: STATE OF ALABAMA

Text Not Available Online

APPENDIX E

GRAPHICAL DISPLAY OF

DATA NORMALITY

Text Not Available Online

APPENDIX F

COMBINED DATA:

PILOT STUDIES

Text Not Available Online

APPENDIX G

SUGGESTED GUIDELINES

FOR CHARACTERIZATION OF

SMALL SCALE DEBRIS CONTAINING LEAD-BASED PAINT

The following discussion describes various "types" of debris that

are commonly "contaminated" with lead-based paint. The discussion

assumes that lead-containing paint has been previously identified

(either through laboratory analyses, XRF testing, spot-tests, or

historic knowledge. If NO information is available regarding the

existence of lead in the painted surfaces, screening with one of

these methods (i.e., lab analyses, XRF, etc.) is recommended in

that it will provide information for worker protection and may

reduce analytical costs for waste characterization.

After each "category" of waste, a waste characterization is

provided: HW = hazardous waste (as per RCRA 40 CFR 261); SW =

non-hazardous waste. These waste characterizations are provided

as a tool to assess your operation's wastestream and determine

when analyses may be warranted or when enough information is

available to characterize your waste based on "generator

knowledge." There may be exceptions to the waste

characterizations listed, the information is based on general

industry-based findings.

Keep in mind that when waste is deemed to be SW (i.e,

non-hazardous) some limited sampling may be warranted for

"liability's sake." Classifying waste as HW without sampling and

analyses, on the other hand, may be over conservative and result

in classifying some non-hazardous wastes as HW. While HW disposal

is more expensive than regular SW disposal, the costs of sampling

and analytical analyses (specifically the Toxicity Characteristic

Leachate Procedure (TCLP) for lead) do add up. A cost analyses

may be beneficial to determine the most practical approach for

your individual needs.

Finally, keep in mind that these suggested guidelines are all

based on FEDERAL regulations. Individual States and localities

may have more stringent requirements and therefore should be

consulted when determining waste disposal practices.

WASTE TYPES AND TYPICAL CHARACTERIZATIONS

4 CATEGORIES OF DEBRIS

WASTE

CHAR

(1) Whole Building Demolition Debris. Consists of all building

SW components (painted and non-painted) to include wood,

brick, cement (foundations), plaster, drywall, etc. that are torn

down during demolition and hauled off site for disposal. Waste

characterization is based on analyses of samples that are

"representative" of the waste. Therefore, proportionate

quantities of the various structural components should be

obtained (e.g., by coring or drilling through the materials) and

combined for analyses in accordance with the TCLP requirements.

(2) Partial Demolition (Building Renovation). This waste stream

SW/ consists of a mixture of components (painted and non-

painted) such HW/ as those in whole building demolition debris,

but the mixture is both less than the entire structure. The

volume of hazardous waste may be through careful characterization

and segregation of individual components. Where segregation is

not practical for a particular operation the overall

"representative" sample approach used for whole building

demolition should be used. A cost analyses may be

beneficial to determine waste management practices.

(3) Components. This waste stream includes lead painted or

HW varnished components removed for remodelling, abatement or

maintenance purposes. Such components include baseboards, window

frames, doors, trim, etc. Usually, the proportion of paint to the

overall mass of the waste is sufficient to result in a relatively

"high" TCLP concentration, therefore resulting in a hazardous

waste. Some minimal sampling may be beneficial.

(4) Contaminated Media/Items. This category encompasses

everything from the paints chips/scrapings to solvents to

personal protective clothing and other items that are

"contaminated" with dust or paint chips/residues. Some of items

are listed below with associated discussion and waste

characterizations.

- Paint chips/scrapings. Contain and collect. Should be

HW handled, packaged, and disposed as a HW.

- Blast grit. Since there are different types of grit

material HW/ and degree of contamination will vary, limited

sampling is SW recommended.

- Solvents. These may be hazardous for constituents other

than HW lead, specifically for HW RCRA "listed" compounds. The

Material Safety Data Sheets (MSDSs) or other product information

should be referred to for more information. "Listed" compounds

are Hws regardless of lead concentrations. For otherwise

nonhazardous solvents, the concentrations of lead must be

established after use for ultimate waste characterization. Some

solvents may be able to be distilled/recycled. While the

"cleaned" solvent would not be a HW, any sludge or filters used

for recycling purposes are probably HWs (see below.)

- Caustic Pastes. Due to different compounds and different

HW/paints, minimal sampling ~IW/ and analyses is suggested.

SW

- Water. Water may be used during blasting, decontamination,

rinsing, etc. Due to the different uses, minimal sampling is

recommended. Whenever possible, recycling of water is

recommended;filters used in recycling may be HW (see below).

- Filters, sludges, etc. From air filters, water filters/

HW recycling, or solvent reclamation operations, these items are

usually very "concentrated" wastes that are high in lead and

therefore a HW.

- Plastics, tarps, PPE. To the degree possible, these items

HW should be reused. At the ~w end of an operation or when

disposal of these items is otherwise necessary, best management

practices include proper containment (i.e., drumming) handling

and disposal. In general, it may be most cost efficient to

classify these wastes as a HW without sampling.

- Soil. Soil that is "contaminated" with lead may [based on a

HW health risk assessment HVV and/or EPA Office of Solid Waste

and Emergency Response (OSWER) Lead Clean-up levels of 500-1000

ppm] have to removed from a site and properly disposed. Similar

to other materials previously discussed, the waste

characterization of this removed soil will depend on a TCLP

analyses for lead. Limited sampling is recommended to

characterize the waste soil.

APPENDIX H

SOIL LEAD CLEAN-UP LEVELS

Currently Available Lead Clean-UP Levels/Allowable Concentrations

Source Level Basis & Comments

CDC (1985)' 500-lOOOmg/kg Soil levels that are unlikely

to cause increased blood lead

levels in children used as

interim criteria by EPA

EPA (1989)2

EPA (1991)3 250-500 mg/kg Allowable soil levels to

protect children based on the

EPA Biouptake Model.

Washington State 250 mg/kg and Allowable soil lead levels

for

Dept. of Ecology 100 mg/kg residential and industrial

areas;

(1991)4 respectively.

New Jersey Dept. 100 mg/kg and Allowable soil lead levels

of Env. Protection for residential and

and Energy industrial areas;

(proposed)5 respectively.

New York 250 mg/kg

Dept. of

Environ.

Conservation

(proposed)6

Minnesota 300 mg/kg Allowable soil levels in

Pollution 7 residential areas and

playgrounds.

1 CDC, "Preventing Lead Poisoning in Young Children," Public

Health Service, Chronic Disease Division, Atlanta, GA, July 85.

2 EPA Interim Guidance on Establishing Soil Lead Cleanup Levels

at Superfund Sites, OSWER Directive 9355.4-02, Sept 89

3 EPA User's Guide for Lead A PC/Software Application of the

Uptake/Bioknetic Model 0 50;" Env Criteria & Assessment Office,

Cincinnati, OH; ECAO-CIN; January 1991

4 Washington Dept of Ecology, "The Model Toxics Control Act

Cleanup Regulation Chapter 173-340 WAC;" 1991.

5 New Jersey DEPE; Proposed Rule: Surface Standards for

Contaminated Sites; Site Remediation Program; Trenton, NJ, 1992

6 New York State DEC; Draft Cleanup Policy and Guidelines;

Cleanup Standards Task Force; Albany, NY; October 1991

7 Journal of Protective Coatings & Linings, April 1993,

"Research News;" page 24.

APPENDIX I

EPA BEST MANAGEMENT PRACTICES (BMPs)

FOR STORMWATER RUNOFF & DUST CONTROL

Storm Water Management

For Industrial Activities

Developing Pollution Prevention

Plans and Best Management Practices

3.3 BMPs FOR PAINTING OPERATIONS

Many painting operations use materials or create wastes that are

harmful to humans and the environment. Storm water runoff from

areas where these activities occur can become polluted by a

variety of contaminants such as solvents and dusts from sanding

and grinding that contain toxic metals like cadmium and mercury.

These and other potentially harmful substances in storm water can

enter water bodies directly through storm drains where

they can harm fish and wildlife.

The following questions will help you identify potential sources

of storm water contamination from painting operations on your

site snd BMPs that can reduce or eliminate these sources. Reading

this section can help you eliminate, reduce, or recycle

pollutants that may otherwise contaminate storm water.

Q. Is care taken to prevent paint wastes from contaminating storm

water runoff?

Use tarps and vacuums to collect solid wastes produced by sanding

or painting. Tarps, drip pans, or other spill collection devices

should be used to collect spills of paints, solvents, or other

liquid materials. These wastes should be disposed of Properly to

keep them from contaminating storm water.

PAINTING ACTIVITIES THAT CAN CONTAMINATE STORM WATER:

Painting and paint removal

Sanding Or paint stripping

Spilled paint or paint thinner

Q. Are wastes from sanding contained?

Prevent paint chips from coming into contact with storm water.

Paint chips may contain hazardous metallic pigments or biocides.

You can reduce contamination of storm water with paint dust and

chips from sanding by the following practices:

Avoid sanding in windy weather when possible.

Enclose outdoor sanding areas with tarps or plastic sheeting. Be

sure to provide adequate ventilation and personal safety

equipment. After sanding is complete, collect the waste and

dispose of it properly.

Keep workshops clean of debris and grit so that the wind will not

carry any waste into areas where it can contaminate storm water.

Move the activity indoors if you can do so safely.

Q. Are parts inspected before painting?

Inspect the part or vehicle to be painted to ensure that it is

dry, clean, and rust free. Paint sticks to dry, clean surfaces,

which in turn means a better, longer-lasting paint job.

Q. Are you using painting equipment that creates little waste?

As little as 30 percent of the paint may reach the tarpet from

conventional airless spray guns; the rest is lost as overspray.

Paint solids from overspray are deposited on the ground where

they can contaminate storm water. Other spray equipment that

delivers more paint to the target and less overspray should be

used:

Electrostatic spray equipment

Air-atomized spray guns

High-volume/low-pressure spray guns

Gravity-feed guns.

Q. Are employees trained to use spray equipment correctly?

Operator training can reduce overspray and minimize the amount of

paint solids that can contaminate storm water. Correct spraying

techniques also reduce the amount of paint needed per job. If

possible, avoid spraying on windy days. When spraying outdoors,

use a drop cloth or ground cloth to collect and dispose of

overspray.

Q. Do you recycle paint, paint thinner, or solvents?

These materials can either be recycled at the facility or sent

offsite for recycling. Some recycling options ranked by the level

of effort required follow.

Least Effort:

Dirty solvent can be reused for cleaning dirty spray equipment

and parts before equipment is cleaned in fresh solvent.

Give small amounts of left-over paint to the customer for

touchup.

Moderate Effort:

Arrange for collection and transportation of paints, paint

thinner, or spent solvents to a commercial recycling facility.

Most Effort:

Install an onsite solvent recovery unit. If your facility creates

large volumes used solvents, paint, or paint thinner, you may

consider buying or leasing an onsite still to recover used

solvent for reuse. Contact your state hazardous waste management

agency for more information about onsite recycling of used

solvents.

CHAPTER

4

SITE-SPECIFIC INDUSTRIAL STORM WATER BMPs

This chapter describes some of the possible Best Management

Practices (BMPs) that you mioht include in your Storm Water

Pollution Prevention Plan so that pollutants from your site do

not mix with storm water.

Table 4.1 provides an easy index of the BMP descriptions that

follow. The BMPs are grouped by section into six categories: Flow

Diversion Practices; Exposure Minimization Practices; Mitioative

Practices; Other Preventive Practices; Sediment and Erosion

Prevention Practices; and Infiltration Practices.

The following information is provided for each BMP: (1 )

description of the BMP; (2) when and where the BMP can be used;

(3) factors that should be considered when using the BMP; and (4)

advantages and disadvantages of the BMP. More detailed fact

sheets for a limited number of the Sediment and Erosion

Prevention Practices are included as Appendix E. When

designing these structural controls, EPA recommends that you

refer to any state or local storm water management design

standards.

TABLE 4.1 INDEX OF SITE-SPECIFIC INDUSTRIAL STORM WATER BMPs

Page

Section 4.1 - Flow Diversion Practices 4-3

Storm Water Conveyances 4-4

Diversion Dikes 4-7

Graded Areas and Pavement 4-9

Section 4.2 - Exposure Minimization Practices 4-11

Containment Diking 4-12

Curbing 4-14

Drip Pans 4-16

Collection Basins 4-18

Sumps 4-20

Covering 4-22

Vehicle Positioning 4-25

Loading and Unloading by Air Pressure or Vacuum 4-26

Section 4.3 - Mitigative Practices 4-29

Sweeping 4-29

Shoveling 4-30

Excavation Practices 4-31

Vacuum and Pump Systems 4-32

Sorbents 4-33

Gelling Agents 4-35

Section 4.4 - Other Preventive Practices 4-37

Preventive Monitoring Practices 4-38

Dust Control (Land Disturbances and Demolition Areas) 4-40

Dust Control (Industrial Activities) 4-42

Signs and Labels 4-44

Security 4-46

Area Control Procedures 4-48

Vehicle Washing 4-49

Section 4.5 - Sediment and Erosion Prevention Practices 4-51

Vegetative Practices 4-51

Structural Erosion Prevention and Sediment Control Practices 4-69

Section 4.6 - Infiltration Practices 4-100

Vegetated Filter Strips 4-101

Grassed Swales 4-103

Level Spreaders 4-105

Infiltration Trenches 4-107

Porous Pavements/Concrete Grids and Modular Pavement 4-109

Covering

What Is It

Covering is the partial or total physical enclosure of materials,

equipment, process operations, or activities. Covering certain

areas or activities prevents storm water from coming into contact

with potential pollutants and reduces material loss from wind

blowing. Tarpaulins, plastic sheeting, roofs, buildings, and

other enclosures are examples of covering that are effective in

preventing storm water contamination. Covering can be temporary

or permanent.

When and Where to Use It

Covering is appropriate for outdoor material storage piles (e.g.,

stockpiles of dry materials, gravel, sand, compost, sawdust, wood

chips, de-icing salt, and building materials) and areas where

liquids and solids in containers are stored or transferred.

Although it may be too expensive to cover or enclose all

industrial activities, cover high-risk areas (identified during

the storm water pollutant source identification). For example,

cover chemical preparation areas, vehicle maintenance areas,

areas where chemically treated products are stored, and areas

where salts are stored.

If covering or enclosing the entire activity is not possible, the

high-risk part of the activity can often be separated from other

processes and covered. Another option that reduces the cost of

building a complete enclosure is to build a roof over the

activity. A roof may also eliminate the need for ventilation and

lighting systems (Washington State, 1992).

What to Consider

Evaluate the strength and longevity of the covering, as well as

its compatibility with the material or activity being enclosed.

When designing an enclosure, consider access to materials, their

handling, and transfer. Materials that pose environmental and

safety dangers because they are radioactive, biological,

flammable, explosive, or reactive require special ventilation and

temperature considerations.

Covering alone may not protect exposed materials from storm water

contact. Place the material on an elevated, impermeable surface

or build curbing around the outside of the materials to prevent

problems from runon of uncontaminated storm water from adjacent

areas.

Frequently inspect covering, such as tarpaulins, for rips, holes,

and general wear. Anchor the covering with stakes, tie-down

ropes, large rocks, tires, or other easily available heavy

objects.

Practicing proper materials management within an enclosure or

underneath a covered area is essential. For example, floor

drainage within an enclosure should be properly designed and

connected to the wastewater sewer where appropriate and allowed.

If connection to an offsite wastewater sewer is considered, the

local Publicly Owned Treatment Works (POTW) should be consulted

to find out if there are any pretreatment requirements or

restrictions that must be followed.

FIGURE 4.7 EXAMPLE COVERING FOR INDUSTRIAL ACTIVITIES

(Modified from Washinqton State, 1992: Salt Institute 1987)

Figure Not Available Online

Advantages of Covering

o Is simple and effective

o Is commonly inexpensive

Disadvantages of Covering

o Requires frequent inspection

o May pose health or safety problems if enclosure is built

over certain activities

4.3 MlTlGATlVE PRACTICES

Mitigation involves cleaning up or recovering a substance after

it has been released or spilled to reduce the potential impact of

a spill before it reaches the environment. Therefore, pollution

mitigation is a second line of defense where pollution prevention

practices have failed or are impractical. Because spills cannot

always be avoided at industrial sites, it is necessary to plan

for these events and to design proper response procedures. This

section discusses mitigative BMPs to avoid contamination

of storm water. Most of the mitigative practices discussed are

simple and should be incorporated in your facility's good

housekeeping and spill response plans. The mitigation practices

discussed include manual cleanup methods, such as sweeping and

shoveling, mechanical cleanup by excavation or vacuuming, and

cleanup with sorbents and gels.

Facilities are cautioned that spills of certain toxic and

hazardous substances and their cleanup may be covered under

regulations, including those imposed under the Superfund

Amendments and Reauthorization Act (SARA), the Comprehensive

Environmental Responsibility, Compensation, and Liability Act

(CERCLA), and the Resource Conservation and Recovery Act

(RCRA).

4.4 OTHER PREVENT1VE PRACTICES

A number of preventive measures can be taken at industrial sites

to limit or prevent the exposure of storm water runoff to

contaminants. This section describes a few of the most easily

implemented measures:

o Preventive Monitoring Practices

o Dust Control (Land Disturbance and Demolition Areas)

o Dust Control (Industrial)

o Signs and Labels

o Security

o Area Control Procedures

o Vehicle Washing.

What Are They

Preventive Monitoring Practices

Preventive monitoring practices include the routine observation

of a process or piece of equipment to ensure its safe

performance. It may also include the chemical analysis of storm

water before discharge to the environment.

When and Where to Use Them

Automatic Monitoring Systom--ln areas where overflows, spills,

and catastrophic leaks are possible, an automatic monitoring

system is recommended. Some Federal, State, and local laws

require such systems to be present if threats exist to the health

and safety of personnel and the environment. For material

management areas, monitoring may include liquid level detectors,

pressure and temperature gauges, and pressure-relief devices. In

material transfer, process, and material handling areas,

automatic monitoring systems can include pressure drop shutoff

devices, flow meters, thermal probes, valve position indicators,

and operation lights. Loading and unloading operations might use

these devices for measuring the volume of tanks before loading,

for weighing vehicles or containers, and for determining rates of

flow during loading and unloading.

Automatic Chemical Monitoring--Measures the quality of plant

runoff to determine whether discharge is appropriate or whether

diversion to a treatment system is warranted. Such systems might

monitor pH, turbidity, or conductivity. These parameters might be

monitored in diked areas, sewers, drainage ditches, or holding

ponds. Systems can also be designed to signal automatic diversion

of contaminatod storm water runoff to a holding pond (e.g., a

valve or a gate could be triggered by a certain pollutant in the

storm water runoff).

Manned Operations--In material transfer areas and process areas,

personnel can be stationed to watch over the operations so that

any spills or mismanagement of materials can be corrected

immediately. This is particularly useful at loading and unloading

areas where vehicles or equipment must be maneuvered into the

proper position to unload (see Vehicle Positioning BMP).

Nondestructive Testing--Some situations require that a storage

tank or a pipeline system be tested without being physically

moved or disassembled. The structural integrity of tanks,

valves, pipes, joints, welds, and other equipment can be tested

using nondestructive methods. Acoustic emission tests use high

frequency sound waves to draw a picture of the structure to

reveal cracks, malformations, or other structural damage.

Another type of testing is hydrostatic pressure testing. During

pressure testing, the tank or pipe is subjected to pressures

several times the normal pressure. A loss in pressure during the

testing may indicate a leak or some other structural damage.

Tanks and containers should be pressure tested as required by

Federal, State, or local regulations.

What to Consider

Automated monitoring systems should be placed in an area where

plant personnel can easily observe the measurements. Alarms can

be used in conjunction with the measurement display to warn

personnel. Manned operations should have communication systems

available for getting help in case spills or leaks occur.

Especially sensitive or spill-prone areas may require back-up

instrumentation in case the primary instruments malfunction.

Mechanical and electronic equipment should be operated and

maintained according to tho manufacturers' recommendations.

Equipment should be inspected regularly to onsure proper and

accurate operation.

The pollution prevention team, in consultation with a certified

safety inspector, should evaluate system monitoring requirements

to decide which systems are appropriate based on hazard

potential.

Advantages of Preventive Monitoring Practices

o Pressure and vacuum testing can locate potential leaks or

damage to vessels early. The primary benefit of such testing is

in ensuring the safety of personnel, but it also has secondary

benefits including prevention of storm water contamination.

o Automatic system monitors allow for early warnings if a leak,

overflow, or catastrophic incident is imminent.

o Manning operations, especially during loading and unloading

activities, is effective and generally inexpensive.

o The primary benefit of nondestructive testing is in ensuring

the safety of personnel, but it also has secondary benefits

including early detection of the potential for contaminating

storm water runoff.

Disadvantages of Preventive Monitoring Practices

o Plant personnel often do not have the expertise to maintain

automatic equipment.

o Automatic equipment can fail without warning.

o Automated process control and monitoring equipment may be

expensive to purchase and operate

Dust Control (Land Disturbance and Demolition Areas)

What Is It

Dust controls for land disturbance and demolition areas are any

controls that reduce the potential for particles being carried

through air or water. Types of dust control are:

o Irrigation--Irrigation is a temporary measure involving a

light application of water to moisten the soil surface. The

process should be repeated as necessary.

o Minimization of Denuded Areas--Minimizing soil exposure

reduces the amount of soil available for transport and erosion.

Soil exposure can be lessened by temporary or permanent soil

stabilization controls, such as seeding, mulching, topsoiling,

crushed stone or coarse gravel spreading, or tree plantinD.

Maintainino existino veoetation on a site will also help control

dust.

o Wind Breaks--Wind breaks are temporary or permanent barriers

that reduce airborne particles by slowing wind velocities (slower

winds do not suspend particles). Leaving existing trees and laree

shrubs in place will create effective wind breaks. More temporary

types of wind breaks are solid board fences, snow fences, tarp

curtains, bales of hay, crate walls, and sediment walls.

o Tillage--Deep plowing will roughen the soil surface to bring

up to the surface cohesive clods of soil, which in turn rest on

top of dusts, protecting them from wind and water erosion. This

practice is commonly practiced in arid regions where establishing

vegetation may take time.

o Chemical Soil Treatments (palliatives)--These are temporary

controls that are applied to soil surfaces in the form of spray-

on adhesives, such as anionic aspnalt emulsion, latex emulsion,

resin-water emulsions, or calcium chloride. Tho palliative is the

chemical used. These should be used with caution as they may

create pollution if not used correctly.

When and Where to Use It

Dust controls can be used on any site where dust may be generated

and where the dust may cause onsite and offsite damage. Dust

controls are especially critical in arid areas, where reduced

rainfall levels expose soil particles for transport by air and

runoff. This control should be used in conjunction with other

sedimentation controls such as sediment traps.

What to Consider

To control dust during land disturbance and at demolition areas,

exposure of soil should be limited as much as possible. When

possible, work that causes soil disturbance or involves

demolition should be done in phases and should be accompanied by

temporary stabilization measures. These precautions will minimize

the amount of soil that is disturbed at any one time and,

therefore, control dust.

Oil should not be used to control dust because of its high

potential for polluting storm water discharges.

Irrigation will be most effective if site drainage systems are

checked to ensure that the right amount of water is used. Too

much water can cause runoff problems.

Chemical treatment is only effective on mineral soils, as opposed

to muck soils, because the chemicals bond better to mineral

soils. Therefore, it should be used only in arid regions.

Vehicular traffic should be routed around chemically treated

areas to avoid tracking of the chemicals. Certain chemicals may

be inappropriate for some types of soils or application areas.

For example, spraying chemicals on the soil of an industrial site

adjacent to a school may be dangerous. Local governments

usually have information about restrictions on the types of

palliatives that may be used. Special consideration must be given

to preserving ground water quality whenever chemicals are applied

to the land.

Since most of these techniques are temporary controls, sites

should be inspected often and materials should be reapplied when

needed. The frequency for these inspections depends on

sitespecific conditions, weather conditions, and the type of

technique used.

Advantages of Dust Control (Land Disturbence and Demolition

Areas)

o Can help prevent wind-and-water based erosion of disturbed

areas and will reduce respiratory problems in employees

o Some types can be implemented quickly at low cost and effort

(except wind breaks)

o Helps preserve the aesthetics of the site and screens certain

activities from view (wind breaks)

o Vegetative wind breaks are permanent and an excellent

alterative to chemical use

Disadvantages of Dust Control (Land Disturbance and Demolition

Areas)

o Some types are temporary and must be reapplied or replenished

regularly

o Some types are expensive iirrigation and chemical treatments

and may be ineffective under certain conditions

o May result in health and/or environmental hazards, e.g., if

overapplication of the chemicals leaves large amounts exposed to

wind and rain erosion or ground water contamination

o May create excess runoff that the site was not designed to

control (irrigation)

o May cause increased offsite tracking of mud (irrigation)

o Is not as effective as chemical treatment or mulching and

seeding; requires land space that may not be available at all

locations (wind breaks)

Dust Control (Industrial)

What Is It

Dust controls for material handling areas are controls that

prevent pollutants from entering storm water discharges by

reducing the surface and air transport of dust caused by

industrial activities. Consider the following types of controls:

o Water spraying

o Negative pressure systems (vacuum systems)

o Collector systems (bag and cyclone)

o Filter systems

o Street sweeping.

The purpose of industrial dust control is to collect or contain

dusts to prevent storm water runoff from carrying the dusts to

the sewer collection system or to surface waters.

When and Where to Use It

Dust control is useful in any process area, loading and unloading

area, material handling areas, and transfer areas where dust is

generated. Street sweeping is limited to areas that are paved.

What to Consider

Mechanical dust collection systems are designed according to the

size of dust particles and the amount of air to be processed.

Manufacturers' recommendations should be followed for

installation (as well as the design of the equipment).

If water sprayers are used, dust-contaminated waters should be

collected and taken for treatment. Areas will probably need to be

resprayed to keep dust from spreading.

Two kinds of street sweepers are common: brush and vacuum. Vacuum

sweepers are more efficient and work best when the area is dry.

Mechanical equipment should be operated according to the

manufacturers' recommendations and should be inspected regularly.

Advantages of Dust Control (Industrial)

o May cause a decrease of respiratory problems in employees

around the site

o May cause less material to be lost and may therefore save

money

Disadvantages of Dust Control (Industrial)

o Is generally more expensive than manual systems

o May be impossible to maintain by plant personnel (the more

elaborate equipment)

o Is labor and equipment intensive and may not be effective for

all pollutants (street sweepers)

APPENDIX J

DISPOSAL ALTERNATIVES

Text Not Available Online