UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE PROGRAMS
FEDERAL CENTER BUILDING
HYATTSVILLE, MARYLAND 20782

IX
1

October 18, 1976

Colonel Walter W. Melvin, Jr.
United States Air Force Environmental
Health Laboratory
Kelly Air Force Base, TX 78241

Dear Colonel Melvin:

In response to your recent request, we have issued Permit No. S-1805 for the importation of untreated soil samples. Please note from the permit itself the safeguards which must be followed when importing such material.

The permit has been made valid through Oct. 31, 1978 and may be revalidated upon receipt of a written request. We are enclosing 50 PPQ Form 550 labels. One of these labels should be attached to the outside of each container of soil as evidence that entry has been authorized. Only one label is required for each container of soil regardless of the number of samples contained therein. Additional labels will be supplied upon receipt of a written request.

Soil samples offered for entry without a valid PPQ Form 550 label attached will be held at the port of arrival until the existence of a valid permit has been determined.

Sincerely,

Jack E Lipes

Jack E. Lipes
Head, Permit Unit
National Program Planning Staff

Enclosures

HOLMES & NARVER, INC.
TECHNOLOGY & CONSTRUCTION

A RESOURCE SCIENCES COMPANY

PACIFIC TEST DIVISION | P. O. BOX 200 | APO SAN FRANCISCO, CALIFORNIA 96305
AEC CONTRACT AT(29-2)-20

31 July 1974

SUBJECT: DISPOSAL OF HERBICIDE ORANGE

DATE: 31 July 1974, 1300 Hours

PLACE: JOC Bldg., Room 226
Johnston Atoll

CONFEREES: Major Eugene L. Arnold, USAF Academy
Captain Alvin L. Young, USAF Academy

Mr. R. L. Murphy, Resident Manager, H&N, Inc.
Dr. L. C. Spillman, Jr., Chief Medical Officer
Mr. D. J. Kinslow, Supervisor, Medical Services

A brief meeting was held in the Resident Manager's office to discuss an alternate means of disposing of Herbicide Orange.

A change in the Environmental Protection Agency's stand on Herbicide Orange may permit sale of the product rather than destruction. The product must be sampled for dioxin to determine if the product meets EPA standards.

Two alternatives of sampling the product were considered:

1. Sample each drum individually
2. Sample small lots of twenty drums

The chemical analysis necessary to determine dioxin levels must be done in a mainland laboratory (Dow Chemical, Midland, Michigan).

Referencing the Conference Report of 22 February 1974, Subject: Herbicide Orange Survey, and updating certain elements for recent and anticipated inflation, some approximate costs were calculated.

	Individual Sample	Lot Sample
Labor to redrum	$ 15	$15
New drum from West Coast	50	50
Analysis Cost	70	4
Transportation to West Coast	22	22
Cost per drum	$157	$91

Labor costs include restoring and movement to dockside.

New drum includes transportation from West Coast.

Analysis cost is $70 per sample. A "lot sample" consists of 20 drums.

Transportation to West Coast includes port handling. Costs are based on shipping pallets of four (4) drums each.

The "lot sample" of 20 drums is based upon the capacity of the sump at the new redrumming facility. It is estimated that approximately 1140 "lot samples" would be generated.

The individual sample would require individual drum identification and handling. The drum would require a second handling when cleared for redrumming. This approach appears too expensive.

"Lot sampling" would reduce the cost per drum, could possibly increase the total saleable product by the random diluting of drums containing unacceptable levels of dioxin with quantities of drums containing acceptable levels, and would reduce total handling time.

The present market value of Herbicide Orange is estimated at a minimum of $2,000 per drum. The government's investment is considerably less than that amount, and even adding the higher costs of redrumming "individual samples," significant costs could be recouped through sale of the product.

Empty drum disposal would be the same as that planned if the product is destroyed.

Unacceptable lots would have to be burned, probably on-site with an incinerator constructed for that purpose.

HOLMES & NARVER, INC.
Pacific Test Division - JA

R. L. MURPHY
Resident Manager

RLM:jds

DISTRIBUTION
Conferees
Commander, Johnston Atoll, FCDNA
Director of Logistics, JA, FCDNA
Base Engineer, JA, FCDNA
Director, PASO, Honolulu
General Manager, PTD, Honolulu
USAEC Site Representative, JA
Subject File

UTAH STATE UNIVERSITY · LOGAN, UTAH 84322

AGRICULTURAL EXPERIMENT STATION

OFFICE OF THE DIRECTOR
UMC 48

Jan 14-17, 1975

May 13, 1974

MEMORANDUM

TO: W-82 Committee, "Dissipation and Degradation of Herbicides and Related Compounds in Soil and Water Systems."

FROM: Wynne Thorne

The project revision for W-82 was approved in April by the Committee of Nine. All CRIS forms and budget arrangements for participating projects should be completed soon so the program can move forward effectively after July 1.

The Committee, along with some others in the Soil and Water area, plans to hold its next meeting in Hawaii during the week of January 13, 1975.

WT/ch
CC: Directors

Wynne Thorne

Richard E. Green
Prof. Soil Sci.

Dr. George A. O'Connor
Department of Agronomy
New Mexico State University
Las Cruces, New Mexico 88003

FTS 8-505-766-5511
646-2219

or (505) 646-3405

DEPARTMENT OF THE AIR FORCE
USAF OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY (AFSC)
BROOKS AIR FORCE BASE, TEXAS 78235

18-B

10 APR 1978

REPLY TO ATTN OF: EC

SUBJECT: Trip Report - Johnston Island, 6-10 Jan 78:

TO: EC
SU
QE
CV
CC
IN TURN

1. Place: Johnston Island, Pacific Ocean

2. Inclusive Dates of Travel: 6-10 Jan 78

3. Person Making Trip: Captain Alvin L. Young

4. Primary Mode of Transportation: Commercial Air

5. Purpose of Trip: To collect soil samples on Johnston Island from the site previously used for the storage of Herbicide Orange.

6. Persons Contacted:

a. Capt William J. Cairney, Dept of Chemistry and Biological Sciences, USAF Academy CO. Provided assistance in conducting site selection and in collecting samples.

b. Maj Marshall W. Nay, BCE, FCDNA/FCJ. Deputy Base Commander; Johnston Atoll.

c. Mr. John Merle, Holmes and Narver Resident Manager, Johnston Atoll.

d. Mr. James Hashimoto, Civil Engineer, Johnston Atoll.

7. Comments and Observations:

a. The concept, site selection criteria and proposed analyses schemes are presented in Attachment 1. A total of 42 sampling sites were located, tagged with aluminum caps, charted on a base map, and sampled to a depth of 8 cm. Per the proposed scheme, 14 samples of each treatment were collected (Attachment 2). The coral from each hole was crushed, uniformly mixed and placed into 200 ml bottles for transport to the respective laboratories (University of Utah for chemical analyses, and USAF Academy for microbial analyses).

b. To facilitate future sampling, all samples collected on 8-9 Jan 78, were collected 15 cm directly west of locator tag. Thus, four complete sets of samples can be collected without the problem of sampling in a previously disturbed site. Furthermore, all four samples will be collected within an area of 0.1 m^2 and should thus reasonably represent the same treatment.

c. In the outbriefing to Maj Nay and Mr Merle, I emphasized the importance of minimizing traffic or human activity in the sampling area. Such activity could potentially a) disturb or destroy the location of the 42 sampling sites, b) further contaminate the sites with additional extraneous hydrocarbons (fuel, motor oil, tire residue, etc.), and c) extend the present area of herbicide and TCDD contamination to non-contaminated areas. I recommended that the entire area should be closed pending analyses of data for at least 3 sampling dates (a total period of approximately 18 months). This action has been offically requested and confirmed (Attachments 3 and 4).

Alvin L Young

ALVIN L. YOUNG, Captain, USAF, Ph.D
Consultant, Environmental
Sciences

4 Atch
1. JI Project Description
2. Table 1
3. Msg, 14Z325Z Feb 78
4. Msg, 161850Z Feb 78

JOHNSTON ISLAND HERBICIDE ORANGE

STORAGE SITE MONITORING PROJECT

USAF OEHL/EC
BROOKS AFB TX
JANUARY 1978

CONCEPT

The soil of the 1.5 hectare storage site (used for the storage of Herbicide Orange from Apr 1971 - Sep 1977) consists of highly compacted coral dredged from a surrounding lagoon. Although the coral is relatively homogeneous, the contamination by Herbicide Orange is heterogeneous: dates of spills or the amounts of herbicide or areas involved were not recorded. Thus, the expected variability in herbicides and TCDD concentration throughout the storage site dictated that the monitoring program: (a) provide inferences as to the range of residue levels in the coral for any point on the site; (b) be sufficiently replicated to be statistically valid; (c) be continued over a sufficiently long period of time so that trends in residue degradation are evidenced; and (d) be accomplished within USAF budgetary limitations. In addition, the "ideal" monitoring program should have some method of determining a minimum level of residue that can be considered as biologically and ecologically acceptable, i.e., a "no" significant effect residue level.

SITE SELECTION

Previous analyses of coral samples collected (24 Aug 1974 and 25 Aug 1977) at sites within the inventory area where herbicide spills had occurred indicated that 98% of all herbicides and TCDD residues were found within the top 8cm of soil profile. Thus, the soil monitoring program was confined to a single depth (0-8cm). The sites selected within the storage area for monitoring of residue were determined by whether a spill had occurred or not occurred at that specific location. The basis for determining a spill was whether a herbicide stain was discernible (heavy, light, absent) and whether a herbicide odor was detectable (strong, mild, absent). Thus, within the storage area numerous locations were found that had a heavy stain and strong odor (labeled H/H, presumably representing a recent spill); a light stain and mild odor (labeled L/L, presumably representing an older spill); and no stain and no odor (labeled 0/0, presumably representing an uncontaminated area). Fourteen replications of each treatment were then randomly selected to represent the storage area (thus, a total of 42 permanently marked sampling locations). Twelve of these locations (four of each of the treatments) were located and marked on 25 Aug 1977 with the remaining 30 located and marked on 8 Jan 1978. [The first complete set of soil samples were collected 9 Jan 1978.]

CHEMICAL ANALYSES

Soil samples will be collected and placed into new glass jars (400ml) appropriately labeled and transported to the laboratory where they will be uniformly mixed and subsampled. One subsample will be used for chemical analysis and will be immediately frozen. The remaining sample will be used for microbial studies (see microbial analyses). Each soil sample will be analyzed for the esters and acids of 2, 4-dichlorophenoxyacetic acid (2, 4-D) and 2, 4, 5-trichlorophenoxyacetic acid (2, 4, 5-T). In addition, each sample will be analyzed for di and trichlorophenols (immediate degradation products of 2, 4-D and 2, 4, 5-T) and TCDD (2, 3, 7, 8-tetrachlorodibenzo-p-dioxin).

MICROBIAL ANALYSES

To determine an ecologically acceptable "no effect" residue level, all samples will be analyzed for total populations of actinomyctes, fungi and bacteria. In addition, key species responding to the presence of herbicides, phenols, or TCDD residues will be monitored. Quantitative and qualitative studies of the microorganisms from each of the treatment classes used in association with residue data should permit an establishment of a no effect level.

TABLE 1

Soil Samples Collected 8-9 Jan 78
and their Respective Characterizations. Samples Collected
from Johnston Island in Support of Site Monitoring Project.

Sample Number	Characterization	Sample Number	Characterization
1	0/0	22	0/0
2	L/L (0/0)	23	0/0
3	0/0	24	L/L
4	0/0	25	L/L
5	H/H	26	L/L
6	H/H	27	L/L
7	L/L	28	L/L (H/H)
8	L/L	29	L/L
9	H/H	30	L/L
10	H/H	31	L/L
11	H/H (L/L)	32	L/L (H/H)
12	H/H	33	L/L
13	0/0	34	L/L
14	0/0	35	H/H
15	0/0	36	H/H
16	0/0	37	H/H
17	0/0	38	H/H
18	0/0 (L/L)	39	H/H (L/L)
19	0/0	40	H/H
20	0/0	41	H/H
21	0/0	42	H/H

D-34

TOR-0860059Z

NLN-026377

15 FEB 78 02 27

AL/DS
AL/AC
ROUTINE
AL/PP

RPTUZCXW RUHHJTA0117 0460017-UUUU--RUVKAAA.
ZNR UUUUU
R 142357 FEB 78 ZFX
FM COMMANDER JOHNSTON ATOLL/FCJ
TO RUVKAAA/OEHL KELLY AFB TX/OLAA
INFO RUWTFBF/FCDNA KIRTLAND AFB NM/FCL
BT
UNCLAS
SUBJECT: HERBICIDE ORANGE DISPOSAL PROGRAM
1. FOR THE PERIOD 10-12 JAN 78 CAPT A. L. YOUNG OF YOUR ORGANIZATION AND CAPT W. J. CAIRNEY OF USAFA/DFCBS VISITED JA FOR A STAFF ASSISTANCE VISIT RELATIVE TO THE ABOVE SUBJECT.
2. AMONG THE ITEMS DISCUSSED WERE:
   A. CHANGE THE FREQUENCY OF WATER SAMPLING FROM ONCE EVERY TWO WEEKS TO ONCE PER QUARTER.
   B. FENCE OFF THE OLD HERBICIDE STORAGE AREA ON THE NW CORNER OF JI.
3. WE HAVE NOT YET RECEIVED FINAL WRITTEN GUIDANCE ON THESE ITEMS. REQ YOU PROVIDE SAME AT YOUR EARLIEST CONVENIENCE. FOR YOUR INFORMATION WE ERECTED TEMPORARY BARRICADES AROUND THE STORAGE AREA AS AN INTERIM MEASURE.
BT
#0117

NNNN

TOR-0460059Z
ROUTINE
NLN-026377

ATCH 3

~~201~~ file 8/1 5A

1 1 RR RR UUUU 161850Z FEB 78

USAF OEHL BROOKS AFB TX/EC

COMMANDER JOHNSTON ATOLL/FCJ

INFO: FCDNA KIRTLAND AFB NM/FCL

UNCLAS

SUBJ: HERBICIDE ORANGE DISPOSAL PROGRAM YOUR MSG 142325Z FEB 78.

1. REFERENCE IS MADE TO ITEMS DISCUSSED DURING CAPT YOUNG'S TDY IN JAN 78. ITEM 2A, YOUR MSG, THE FREQUENCY OF WATER SAMPLING AND MODIFICATION OF THE WATER SAMPLING PROGRAM WERE CONTAINED IN USAF OEHL/CC LTR DTD 3 FEB 78. ITEM 2B, YOUR MSG, PURPOSES OF EXCLUDING VEHICULAR TRAFFIC OVER OR ON THE FORMER STORAGE SITE IS TO REDUCE UNNECESSARY SPREADING OF KNOWN CONTAMINATION FROM THE SITE, PRECLUDING ANALYTICAL INTERFERENCES IN SAMPLES COLLECTED DURING THE MONITORING PROGRAM.

2. AS DISCUSSED WITH JOHNSTON ISLAND STAFF DURING JAN TDY, TEMPORARY BARRICADES FOR EXCLUDING TRAFFIC WILL BE SUFFICIENT. ESTIMATE MAXIMUM EXCLUSION APPROXIMATELY 18 MONTHS.

JAMES R. TREMBLAY, Major, USAF, BSC
Acting Chief, Consultants Division/EC
X2891, 15 Feb 78 lmp

CURTIS, MICHAEL, SU, 3422
ADMIN ASST

UNCLASSIFIED

Atch 4

D21 file

DEPARTMENT OF THE AIR FORCE
USAF OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY (AFSC)
BROOKS AIR FORCE BASE, TEXAS 78235

20 JUN 1979

REPLY TO ATTN OF: CC

SUBJECT: Final Report OEHL TR-78-87, Sept 1978, "Land Based Environmental Monitoring at Johnston Island - Disposal of Herbicide Orange"

TO: See Distribution

1. The subject report is provided for your information. This report, prepared under contract by Battelle Columbus Laboratories, Columbus, Ohio, documents the results of occupational and environmental monitoring of the Herbicide Orange land-based dedrumming and transfer operations conducted at Johnston Island during July and August 1977. This report concludes that the Herbicide Orange disposal operations of dedrumming, hauling, and transferring the herbicide to the incinerator ship, M/T Vulcanus, had negligible impact on the local marine and surface terrestrial environment of Johnston Island. In addition, the results of industrial hygiene observations revealed that personnel exposures to herbicide vapors were well below permissible levels.

2. A report covering the Herbicide Orange land-based operations at the Naval Construction Battalion Center (NCBC), Gulfport, Mississippi, in June 1977 is currently in press and will be distributed in the near future. No significant adverse environmental or occupational impact was noted during the NCBC operations.

3. A technical report covering the shipboard incineration operations has been published ("At-Sea Incineration of Herbicide Orange Onboard the M/T Vulcanus," EPA-600/2-78-08-6, April 1978). This report, prepared under contract by TRW, Inc., Redondo Beach, California, documented full compliance with all Environmental Protection Agency (EPA) permit requirements for the shipboard incineration operations. A copy of the EPA report may be obtained through the National Technical Information Service, Springfield, Virginia 22161.

William E. Mabson
WILLIAM E. MABSON, Colonel, USAF, BSC
Commander

1 Atch
OEHL TR-78-87, Sept 1978

Distribution:

HQ AFESC/DEV	1	HQ AFLC/OI	3
HQ AFESC/RD	1	HQ AFLC/LG	1
DASD (EES&S)	2	HQ AFLC/LOS	1
OL AD USAF OEHL	1	HQ AFLC/LOT	1
USD RE (E&LS)	2	HQ AFLC/LOI	1
SAF/MIQ	2	HQ AFSC/SGPA	1
SAF/ALG	2	HQ ATC/SGPA	1
SAF/OIP	3	HQ PACAF/SGPA	1
HQ USAF/SGES	2	HQ PACAF/LG	1
HQ USAF/LG	1	HQ PACAF/OIP	3
HQ USAF/SGI	1	HQ DNA/OALG	1
HQ AFMSC/SGPA	1		
HQ AMD/CC	1		
HQ AMD/RD	1		
HQ AMD/OI	3		
HQ FCDNA/FCLS	5		
CINCPAC/J 423	2		
US EPA (WH-548)	3		
EPA Region IX	1		
SA-ALC/SF	1		
SA-ALC/AC	1		
SA-ALC/OI	2		
Naval Ordnance Station/NOL	1		
HQ AFLC/CC	1		
HQ AFLC/SGPA	1		

Fishburn/ECW/3305/19Jul79/kb

27 JUL 1979

ECW

Sampling Frequency for Johnston Island Herbicide Orange Monitoring Sites

Defense Nuclear Agency
Johnston Atoll Field Command
APO San Francisco 96305

1. A review of analytical results for environmental ocean samples for the period of April 1972 through March 1979 indicates there is no significant contamination of ocean waters surrounding Johnston Island by 2,4-D or 2,4,5-T.

2. We recommend a reduction in the frequency of routine sampling from quarterly to semiannually for the following ocean sites:

Off the main pier
Off North Island
Off the LOX plant
Off the east end of the runway
Off the salt water intake
Off the west end of the runway

3. We recommend maintenance of the current quarterly sampling schedule for the following ocean site:

Shoreline, herbicide area

4. If we can be of further assistance to you, please contact us at AUTOVON 240-3305.

SIGNED

GARY A. FISHBURN, Major, USAF, BSC
Chief, Water Quality Branch

Cy to: DNA, Kirtland Field Command

1. SUBMITTED BY	2. DATE REC'D	3. SAMPLE NUMBER
[illegible]		77PE03059-70
4. ANALYSIS REQUESTED		**5. ANALYST**
Herbicides		MR, VAN

6. SAMPLE DESCRIPTION

7. METHODOLOGY

Gas Chromatography

8. RESULTS

LAB CONTROL NUMBER - BASE CONTROL NUMBER

CONCENTRATION in 1 LITER SAMPLE - NANOGRAMS/LITER*

SAMPLE ANALYZED FOR	Quantitative Detection Limit (1 Liter sample) Nanograms/Liter (parts per trillion)	77PE03059 77-267	77PE03060 77-268	77PE03061 77-269	77PE03062 77-270	77PE03063 77-271	77PE03064 77-272	77PE03065 77-273	77PE03066 77-274	77PE03067 77-~~275~~	77PE03068 77-276	77PE03069 77-277	77PE03070 77-278
Butyl ester of 2,4-D	60	X	X	X	X	X	X	X	X	X	X	X	X
Butyl ester of 2,4,5-T	60	X	X	X	X	X	X	X	X	X	X	X	X
2,4-Dichloro-phenoxyacetic acid (2,4-D)	60	X	X	X	X	X	X	~600	X	X	X	X	X
2,4,5-Trichloro-phenoxyacetic acid (2,4,5-T)	60	X	X	X	X	X	X	~550	X	X	X	X	X
iso-Octyl ester of 2,4-D	60	X	X	X	X	X	X	X	X	X	X	X	X
iso-Octyl ester of 2,4,5-T	60	X	X	X	X	X	X	X	X	X	X	X	X
A compound similar to Aroclor 1248	400	X	X	X	X	X	X	X	X	~1770	~1670	~3420	~3410

9. REMARKS

LOG OUT AND FILE. SEND COPY OF BOTH TO CAPT. PONTEIR AT KELLY AFB.

YOSHIMI A. NISHIOKA, Chemist

T.T.

10. DATE 30 NOV 77

SACRAMENTO ALC FORM APR 69 397

DATA SHEET FOR SAMPLE ANALYSIS

TO: U S A F ENVIRONMENTAL HEALTH LAB., MC CLELLAN AFB, CA 95652 — Date Submitted 25 Oct. 1977

FROM: FIELD COMMAND, JOHNSTON ATOLL, DEFENSE NUCLEAR AGENCY APO SAN FRAN., 96305

Base Sample Control Number: 77-267 thru 77-278 — Lab Sample Control Number:

TYPE SAMPLE: SEA AND FRESH WATER SAMPLES

AREA SAMPLED (Complete) JOHNSTON ISLAND LAGOON AND FRESH WATER DISTRIBUTION.

DATE COLLECTED: 24 Oct 1977 — HOUR COLLECTED: 0900 hrs & 1300 hrs.

ANALYSIS DESIRED: QUANTITATIVE AND QUALITATIVE FOR 2,4-D & 2,4,5,-T (HERBICIDE)

METHOD OF SAMPLING (Composite, Grab, Etc) GRAB METHOD

REMARKS:

77-267 OCEAN, OFF MAIN PIER
77-268 OCEAN, OFF LOX PLANT
77-269 OCEAN, OFF WEST END RUNWAY
77-270 OCEAN, OFF NORTH ISLAND
77-271 OCEAN, OFF EAST END RUNWAY
77-272 OCEAN, at SALT WATER INTAKE
77-273 OCEAN, SHORELINE, HERBICIDE AREA
77-274 FRESH WATER STORAGE TANK, DIST. PLANT
77-275 FRESH WATER TAP, JOC BLDG.
77-276 FRESH WATER TAP, DISPENSARY
77-277 FRESH WATER TAP, MESSHALL
77-278 FRESH WATER RESERVOIR, 200,000 Gallon Tank.

~~NB~~ NOTE: PLEASE SHIP TO THIS JOB-SITE ADDITIONAL SAMPLE BOTTLES.

GENERAL PURPOSE WORKSHEET

Coral Samples
Johnston Atoll
25 Aug 97

1	25 Aug 97, JJ	Control, Loc. # 1, 0-6"
15 2	25 Aug 97, JJ	O/O, Storage Site, Loc. # 2, 0-6"
16 3	25 Aug 97, JJ	O/O, Storage Site, Loc. # 3, 0-6"
17 4 029	25 Aug 97, JJ	O/O, Storage Site, Loc. #4, 0-6"
18 5	25 Aug 97, JJ	L/L, Storage Site, Loc. #5, 0-6"
19 6	" " "	L/L, " " " 6 0-6"
20 7	" " "	" " " " 7 "
21 8	" " "	" " " " 8 "
220 D	" " "	H/H " " " 9d 18-24"
9C	" " "	H/H " " " 9c 12-18"
9B	" " "	" " " " 9b 6-12"
9A	" " "	" " " " 9a 0-6"
26 10	" " "	" " " " 10 "
27 11	" " "	" " " " 11 "
28 12	" " "	" " " " 12 "

Soil Biodegradation Study
Johnston Atoll
1 Sept 97
Description

1, 1 Sept 97	Control, Coral Samples	O/O,	30-36 inch	#1 F
2	" "		24-30	#1 E
3			18-24	#1 D
4			12-18	#1 C
5 030			6-12	#1 B
6 031			0-6	#1 A
7	Storage Site	H/H	30-36	#10 F
8			24-30	10 E
9			18-24	10 D
10			12-18	10 C
11 027			6-12	10 B
12 [illegible] 028			0-6	10 A
13	Storage site	H/H	30-36	11 F
14			24-30	11 E
15			18-24	11 D
16			12-18	11 C
17 034			6-12	11 B
18 035			0-6	11 A
19			30-36	12 F
20			24-30	12 E
21			18-24	12 D
22			12-18	12 C
23 036			6-12	12 B
24 037			0-6	12 A

SUBJECT: MEMO FOR THE RECORD - CoralSamples from Herbicide Orange Site, Johnston Island 29 August 1977

1. On 25 Aug 77, 15 coral samples were collected from twelve separate sites in the Herbicide Orange storage area at Johnston Island. These sites were located and marked by the base civil engineer using surveying equipment. A bench mark is located in the northwest corner of the storage site and all bearings, distances and coordinates were recorded from that bench mark.

2. All samples were collected from the 0-6 inch level except sample site number nine which was sampled at 0-6, 6-12, 12-18 and 18-24 inch levels. Sample number 1 represents the control sample taken just over 100 feet up wind of the herbicide storage site. This sample was taken between the existing road and drainage ditch and should be well outside any area of traffic and accidental contamination. The elevation at site 1 is higher than the storage site which would preclude drainage from the storage site to the control area. Samples 2, 3, and 4 represent areas with no visible signs of H.O. spill and no H.O. odor in the field. However, when these samples were brought into the laboratory a slight H.O. odor could be detected. Samples 5, 6, 7, and 8 were collected from areas with light H.O. stain and slight H.O. odor. These sample holes were typically stained with H.O. in the top 1/8 - 1/4 inch of the sample. This top material was composed of compacted H.O. stained coral. A light stain could then be seen for 1/8 - 1/2 inch below this heavy compacted layer. The odor of herbicide could be detected throughout the sample. Sites 9, 10, 11, 12 represented large,long standing, heavy,H.O. stains and had a very strong H.O. odor. The compacted layer on these sites were typically 1/4 - 3/4 inches thick with visable stain carrying down 1/4 - 1 inch below that. A strong H.O. odor was detected in all 0-6 inch samples. At site number 9, H.O. odor was detected at 0-6, 6-12 and slight odor at 12-18 inches. No odor at 18-24 inch level.

3. All sites were photographed while collecting the sample. Each sample was mixed but the large pieces of material were not broken up. The sample was collected in 1 Qt wide mouth jars with a 2 oz jar being filled with several subsamples during the filling of the 1 Qt jar. These subsamples were labeled and sent by priority mail to Major Cairney USAFA/DFCBS, USAF Academy CO 80840 on 26 Aug 77, for soil microrganism studies. The 1 Qt jars were labeled and placed in a deep freeze pending shipment to OL AA USAF OEHL, Kelly AFB TX 78241. The expected date of shipment for these 15 Coral

samples is Friday 2 Sep 77.

4. No samples were taken from the center of the storage site due to the heavy traffic pattern created during the dedrumming operation. It was felt this particular area would possible have a significant amount of cross contamination. The sampling sites selected in less heavily traveled parts of the storage area are representative of the spills seen throughout.

Charles E. Thalken

CHARLES E. THALKEN
Major, USAF VC
Project PACER HO, Environmental Consultant

1 ATCH
1. Survey coordinates

TEST HOLE	BEARING	DISTANCE	COORDINATES	
			NORTH	EAST
TH-1	S 76° 20' E	652.00	197,644.74	193,884.15
TH-2	S 89° 19' E	450.88	197,785.41	193,701.29
TH-3	S 68° 14' E	117.61	197,755.18	193,359.84
TH-4	S 4° 16' W	224.85	197,574.56	193,233.88
TH-5	N 87° 52' E	386.69	197,813.19	193,637.03
TH-6	N 38° 29' E	131.49	197,901.72	193,332.34
TH-7	S 30° 02' E	236.09	197,594.40	193,363.77
TH-8	S 79° 44' E	511.85	197,707.56	193,754.27
TH-9	S 77° 07' E	381.14	197,713.81	193,622.16
TH-10	S 60° 12' E	343.19	197,628.23	193,548.42
TH-11	S 17° 48' 30" E	282.88	197,529.46	193,337.12
TH-12	S 20° 20' E	53.10	197,749.00	193,269.06

TCDD ANALYSIS, LIQUID ORANGE SAMPLES

Analysis Performed by ARL/LJ, WPAFB, Ohio

Samples submitted: 1 February 1975

Data Received: 11 March 1975

Sample Source	Sample Number	Date Sampled	TCDD PPM	
*Johnston Island	1	1 Aug 74	< 0.25	(a)
" "	2	"	1.3	(a)
" "	3	"	0.3	(a)
" "	4	"	< 0.07	
" "	5	"	< 0.07	
" "	6	"	0.07	
" "	7	"	4.6	
" "	8	"	4.6	
" "	9	"	5.3	
" "	10	"	0.28	
**Eglin AFB	1	1 Jan 70	< 0.04	
***Eglin AFB	2	"	< 0.04	

(a) TCDD peak appeared on top of large interference peak.

* Samples collected from Drums that were to be re-barrelled.

** Sample routinely used at USAFA for laboratory experiments.

*** Samples used in Biodegradation Plots, Eglin AFB, Florida, April, 1972.

AN ECOLOGICAL AND HERBICIDE-RESIDUE STUDY OF THE ORANGE HERBICIDE STORAGE SITE, JOHNSTON ISLAND AUGUST 1974

DECEMBER 1974

CAPTAIN ALVIN L. YOUNG, Ph.D.

MAJOR EUGENE L. ARNOLD, Ph.D.

DEPARTMENT OF LIFE AND BEHAVIORAL SCIENCES

UNITED STATES AIR FORCE ACADEMY

DRAFT

INTRODUCTION

Since April 1972 Johnston Island (Atoll) has been the storage site of approximately 25,000 drums (1.4 million gallons) or Orange Herbicide. The herbicide was part of a 2.3 million gallon inventory remaining from the termination of the defoliation program in Southeast Asia. The storage on Johnston Island was to be short term while the Department of the Air

of the inventory. To date however, ~~[illegible]~~ the solution to the disposition

Force determined final disposition of the herbicide is still forthcoming. In the interim period continual monitoring of the condition of the drums, and subsequent re-drumming when required, has been a necessity for the Air Force. Futhermore, periodic environmental surveys of the storage areas have been conducted to insure that any herbicide spillage and/or leakage was not adversely effecting the surrounding biota.

The present survey was undertaken at the request of Headquarters AFLC and was designed to (a) determine the extent of lateral and vertical movements of herbicides in the coral of the storage site, and (b) conduct a cursory ecological survey of the surrounding flora.

METHODS AND MATERIALS

A survey of the Herbicide Storage Site on Johnston Island was conducted 30 July - 1 August 1974. Prior to sample collection, the entire storage site and surrounding area were examined. Notes were taken on areas within the storage site that appeared contaminated with herbicides. These sites were then checked by interviewing two employees of Holmes and Narver Incorporated, the civilian contracting firm having responsibility for maintaining the inventory. The two employees interviewed were engaged in a continual screening and re-drumming operation. (The entire inventory of 24.788 drums was screened daily and "leakers" were identified and removed to the re-drumming area. Re-drumming occured on Saturday mornings for all drums identified as leakers during the week.

RESULTS AND DISCUSSIONS

~~Environmental~~ Summary of the Physical Environment

Johnston Atoll is located at latitude 16 degrees 45 minutes north and longitude 169 degrees 30 minutes west. It is one of the most isolated atolls in the Pacific Ocean. Johnston Atoll consists of a pair of low sand and coral islands, Johnston and Sand Islands, with a combined area of approximately 648 acres. The herbicide storage site is located on the northwest corner of Johnston Island. Winds are dominant from the east to the west and as a result any vapors from spillage or leakage of the Orange herbicide would normally be carried away from the personnel area and out to sea. Concurrently, ocean currents immediately off-shore from the storage site, predominantly move from the east to the west. Thus, water transport of any herbicide which may be accidentlly spilled would generally be away from the island. Ocean currents in the vicinity of Johnston Island run at a speed of about 1/2 knot or from 10 to 15 miles per day.

The climate of Johnston Atoll is marine and tropical. The mean annual temperature is 79.3 F with the daily maximum and minimum temperatures varying only a few degrees throughout the year. The mean annual precipitation is 26.11 inches, but year-to-year variation is great. The annual mean relative humidity is 75 percent, being highest at 0100 hours (78 percent) and lowest at 1300 hours (69 percent). The mean annual wind speed is 15.1 miles per hour with very little variation throughout the year.

The condition of the storage area provided evidence of rapid identification of leakers since only a few spillage areas were observed.) The two employes confirmed two sites that had been contaminated with significant quantities of herbicide. The first sample (U-2) came from a site identified as location U-2 (drums in the storage are arranged in columns, alphabitized, and in rows, numbered sequententy) and was the site where a 55 gallon drum of herbicide had ruptured in May 1974, (two month earlier). The second sample (sample N-2) came from a site identified as location N-7 and was the site where a 55 gallon drum of herbicide had ruptured in late February 1974 (five months earlier).

Since the entire site was established upon crushed and packed coral, samples U-2 and N-2 were obtained by use of pick, shovel, and trowell. A hole twelve inches deep was excuvated by use of the pick and shovel. Once the initial hole was dug, the trowell was used to carefully clean excess debri from one wall. Following measurement, two ~~inches~~ -inch increments of coral ~~increment~~ were removed to a depth of ten inches. Each two-inch increment was transferred to a 6 ounce new class jar and capped with aluminum foil and the lid. Coral samples were then taken back to the Air Force Academy, where they were analyzed for 2,4-D and 2,4,5-T herbicide. Selected samples were shipped to the Aerospace Research Laboratory, Wright-Patterson AFB, Ohio, for analysis of TCDD, 2,3,7,8-tetrachlorodibenzo-p-dioxin.

The following is a report on the analysis for residual herbicide on twelve soil (coral) samples obtained on 30 July 1974 from the Herbicide Orange storage and redrumming area on Johnston Island.

Description of samples: Samples 1-5 were obtained from an area of the storage yard designated by the quadrants U,2. They consist of depth increments of 0-2", 2-4", 4-6", 6-8 and 8-10" taken from an area where a drum of Orange had previously ruptured, spilling the contents on the surface of the coral. It was determined from conversations with workers in the area (redrumming crew) that this spill had occurred in late May 1974 or approximately 2 months prior to sampling. Discoloration of the surface was still much in evidence and a slight herbicide odor could be detected.

Samples 6-9 were obtained from an area of the storage yard designated N,7 where a drum had ruptured approximately 5 months prior to sampling. They consist of depth increments of 0-2", 2-4", 4-6". In this area discoloration was less evident and little odor could be detected. Sample 10 was taken directly below the redrumming apparatus, in an area where considerable spillage had taken place. It consisted of a 0-4" increment

Sample 11-12 represent control samples taken outside the storage and redrumming area. The former was obtained approximately 5 yards from the shoreline in the vicinity of storage yard while the latter was obtained from an area approximately 1/2 mile north of the storage area. Both were 0-4" depth increments.

Discussion:

Several conclusions can be drawn from the above data. First, it appears likely that the coral of the island degrades herbicide orange at a relatively rapid rate. This is evident from the higher concentrations determined in the area of the more recent spill and from the predominance of acid forms (1st stip in the degradation) in the "soil from the area of the spill which occurred 5 months prior to the sampling. Secondly, the hard packed nature of the coral and the insolubility of the ester prevents penetration much in excess of 6-8". In addition, herbicide contamination was not detected outside of the storage yard except in close proximity to the redrumming operation.

Ongoing Efforts:

In addition to the above analyses, the following efforts are presently ongoing.

(a) A number of the coral samples are being sent to ARL WPAFB for TCDD analysis.

(b) The U-2, 0-2" sample and the control coral sample have been forwarded to Dr. Burton Koch, University of Hawaii for his use in detecting breakdown rates in coral employing radio tracers.

(c) Ten drums of Orange were sampled at random and have been analyzed for 2,4-D, 2,4,5-T composition. Seven of these samples indicate a 50/50 mixture of butyl esters of approximately 95-97% purity. One sample contained considerable amounts of water and an unknown volatile material

Results:

Sample #	Description	2,4-D Acid (ppm)	2,4,5-T Acid (ppm)	2,4-D Butyl ester (ppm)	2,4,5-T Butyl ester (ppm)	Total Herbicide (ppm)
1	U-2, 0-2"	4,000	3,320	4,800	7,400	19,520
2	U-2, 2-4"	920	710	1,050	1800	4,480
3	U-2, 4-6"	132	150	188	300	882
4	U-2, 6-8"	60	56	20	86	202
5*	U-2, 8-10	90	86	208	360	744
	U-2 total	5,202	4,322	6,246	9,946	25,716
6	N-7 0-2"	2,400	2,220	900	1,280	6,780
7	N-7 2-4"	500	270	320	320	1,410
8	N-7 4-6"	60	40	<20	<20	100
9	N-7 6-8"	34	42	<20	<20	76
	N-7 total	2,994	2,572	1,220	1,600	8,386
10	Redrum Area	3,800	4,300	3,200	4,900	16,200
11	Offshore Control	<10	<10	<10	<10	<10
12	1/2mi. Control	<10	<10	<10	<10	<10

* It appears that this sample was contaminated by material from an upper depth increment.

Discussion: Several conclusions can be drawn from the above data. First, it appears likely that the coral of the island degrades herbicide orange at a relatively rapid rate. This is evident from the higher concentrations determined in the (low boiling). Two other drums contained numerous high boiling impurities, possibly other herbicide esters. Identification of these unknown contaminants by GC/MS is presently underway. In addition a TCDD analysis for each sample is being sought.

Results of the above investigations will be forthcoming prior to 1 February 1975.

THE UNIVERSITY OF UTAH

FLAMMABILITY RESEARCH CENTER
391 SOUTH CHIPETA WAY
RESEARCH PARK
POST OFFICE BOX 8089
(801) 581-8431

November 7, 1979

Major Alvin Young
USAFSAM/EK
Brooks AFB, TX 78235

Dear Al,

Listed in the enclosed tables are the final pesticide analytical results for the soil samples from the Gulfport, Mississippi and Johnston Island Herbicide Orange storage facilities. These results along with the water sample analysis results discussed below represent completion of the chemical analysis for this contract. A formal final report will be forthcoming to summarize some of our observations of data trends and to augment the first year final report with any analytical procedure changes from last year.

The six enclosed tables contain results from three different types of soil samples for each of the two storage facilities. In Tables 1 and 2 are summarized the results from all the samples taken between July 1977 and August 1979 from Herbicide Orange spill sites at the Gulfport (GP) and Johnston Island (JI) facilities respectively. The sample date code is defined as follows: date code 9 for samples collected 28 July 1977 and 25 August 1977 from GP and JI sites respectively; date code 0 for samples collected in January 1978 from both sites; date code 1 for samples collected 6 November 1978 and 18 October 1978 from GP and JI sites respectively; and a date code of 2 for samples collected 14 June 1979 from a GP site and 8 August from JI sites. Given in Tables 3 and 4 are the results for soil penetration studies done at one GP and two JI sites respectively. The presence of pesticide components is here shown to extend more than 20 centimeters below that soil surface. The analytical results for non-spill sites for GP and JI are listed in Tables 5 and 6 respectively. The samples in these last two tables are primarily water drainage or ocean sediment samples but also include samples from two non-storage site islands in the Johnston Island area and two laboratory blanks. The two laboratory blanks reported were run on Fisher Scientific Co. Washed and Ignited Sea Sand and give some indication of the lower detection limits for the analytical methods. The exact source of these small blank contaminations is uncertain but they appear to possibly come from previous sample carry over. Thus the stated pesticide values for all of the sediment or other low concentration samples represent upper limits of actual contamination.

The twelve water samples from the two storage facilities were analyzed for TCDD only. These included five JI samples labelled JI-1/7879 through JI-5/7879 collected on 7 August 1979. The GP water samples consisted of two labelled simply W-1 and W-2 which were collected on 14 June 1979 and five (out of seven) potable water samples collected on 31 July 1979 which were labelled D331Y9, D431Y9, D131Y9, D231Y9 and D531Y9. Each of these samples were extracted by adding sodium chloride to an aliquot of the water to make a five percent salt solution and then extracting with pesticide grade hexane. The hexane extract was then reduced in volume to 50 microliters and analyzed by GC/MS the same as the soil extracts. The two GP samples from 14 June 1979 labelled W-1 and W-2 were analyzed as 100 milliliter (ml) aliquots and were found to contain <25 parts per trillion (1 ppt = 1 X 10^{-9} gram/liter) of TCDD. The five JI and the other five GP water samples were each analyzed as 200 ml aliquots and were found to contain <20 ppt of TCDD.

I believe these results fully satisfy the analytical requirements of the FRC on this contract and understand that their receipt will begin procedures for completion of payment to the University of Utah. I am still awaiting contact from Lt. Colonel Falcon concerning disposal of our contaminated wastes and samples. As mentioned earlier, the formal final report on this project will be in preparation during the next month. If you have any suggestions for the final report or any other questions or comments please feel free to contact either myself or Mason Hughes.

Sincerely,

Bill McClennen

William H. McClennen

WHM/mv

Enclosures

cc: B. M. Hughes

TABLE 1

SUMMARY OF ANALYTICAL RESULTS FOR HERBICIDE ORANGE, ITS HYDROLYSIS PRODUCTS AND TCDD

IN THE GULFPORT, MISSISSIPPI STORAGE FACILITIES

µg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date[a] Code	Site No.	Dichlorophenol	Trichlorophenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
9	01	ND3[b]	87.3	10500	6120	9483	25500	ND3	ND3	.109
0	01	ND3	628	5920	6460	14300	37300	4000	3100	.328
1	01	ND3	404	4050	19600	930	64.5	140	1650	.198
9	02	0.1	0.6	8.2	20.3	0.6	1.0	1.3	2.9	N/A[c]
0	02	0.6	0.9	0.8	0.4	ND1	0.1	ND2	ND2	N/A
1	02	ND1	0.1	1.4	2.8	ND1	ND1	1.6	0.4	N/A
9	03	ND3	109	13100	13900	41900	63500	ND3	ND3	.631
0	03	0.2	0.5	ND1	0.6	ND1	0.1	ND2	ND2	.0048
1	03	ND1	0.1	1.5	0.3	ND1	ND1	ND2	ND2	.0022
9	04	ND2	0.2	7.4	6.6	ND2	1.2	ND2	ND2	N/A
0	04	0.3	0.7	0.1	0.8	ND1	0.3	ND2	ND2	N/A
1	04	ND1	0.2	1.2	4.8	ND1	ND1	ND2	ND2	N/A
9	05	ND3	166	7810	3600	7240	18700	ND3	ND3	≤.008
0	05	ND3	402	6120	18500	192	1120	ND3	ND3	≤.002
1	05	ND3	162	805	2340	219	17.7	ND3	ND3	≤.0387
9	06	ND1	0.1	0.3	0.4	0.1	0.1	ND2	ND2	N/A
0	06	1.2	1.9	2.7	3.4	0.4	4.3	ND2	0.5	N/A
1	06	ND1	0.2	3.6	1.4	ND1	0.1	ND2	ND2	N/A
9	07	ND2	0.6	9.0	11.5	0.4	1.1	ND2	ND2	N/A
0	07	3.3	486	570	1110	11.2	73.1	ND2	ND2	<.005
1	07	ND2	0.4	3.2	4.8	ND2	0.3	ND2	ND2	N/A

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Gulfport, Mississippi Storage Facilities (Continued)
PAGE TWO

µg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date Code[a]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
9	08	ND3	95.9	674	369	14800	19000	ND3	ND3	.190
0	08	0.2	0.4	0.2	0.5	ND1	0.1	ND2	ND2	.0046
1	08	ND1	0.1	0.6	0.4	ND1	ND1	ND2	ND2	<.0052
9	09	ND2	0.2	2.9	5.4	ND1	0.1	ND2	ND2	N/A
0	09	1.4	1.0	0.3	0.2	0.1	0.1	ND2	ND2	N/A
1	09	0.2	ND1	0.4	0.4	ND1	ND1	ND2	ND2	N/A
9	10	68.3	235	2140	1420	49900	63600	ND3	ND3	.0185
0	10	ND3	354	4370	1730	11800	11500	8200	26000	.042
1	10	ND3	100	719	2860	ND1	48.5	ND3	17000	.0242
0	11	0.7	1.0	8.8	19.6	0.9	5.3	ND2	ND2	N/A
1	11	ND1	0.2	0.9	2.6	0.2	ND1	ND2	ND2	N/A
9	12	ND1	0.2	2.0	2.2	0.2	ND1	ND2	ND2	N/A
0	12	2.2	1.8	0.6	0.4	0.1	ND1	ND2	ND2	<.0002
1	12	2.1	ND1	0.2	0.6	ND1	ND1	ND2	ND2	N/A
0	13	1.9	3.1	7.2	6.4	0.2	2.2	ND2	ND2	N/A
1	13	0.1	0.6	2.6	4.2	9.9	0.3	ND2	ND2	N/A
0	14	ND3	121	1420	3790	13.0	95.6	ND3	ND3	.10
1	14	ND2	2.9	29.6	40.2	ND2	2.9	ND2	ND2	.105
0	15	2.8	1.6	0.9	1.2	ND1	4.3	ND2	ND2	N/A
1	15	0.5	ND1	0.2	0.3	ND1	ND1	ND2	ND2	N/A
0	16	ND3	648	6950	11800	10300	28200	ND3	ND3	.442
1	16	ND3	316	7920	20300	ND3	2010	ND3	ND3	.198
0	17	384	850	31000	22500	34700	73600	ND3	ND3	.51
1	17	ND3	483	29100	50300	ND3	3050	ND3	ND3	.508
[illegible]	17	ND3	364	27000	33900	ND3	1650	ND3	ND3	.325

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Gulfport, Mississippi Storage Facilities (Continued)
PAGE THREE

µg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date Code[a]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
0	18	2.9	1.2	112	0.5	0.1	0.1	ND2	ND2	≤.0002
1	18	ND1	ND1	1.8	2.6	ND1	ND1	ND2	ND2	N/A
0	19	ND3	110	7530	14400	13.0	73.0	ND3	ND3	.13
1	19	ND3	83.0	6760	13000	ND2	ND2	ND3	ND3	.119
0	20	ND3	82.0	21000	53000	1620	11600	ND3	ND3	.001
1	20	ND3	52.4	20500	45200	ND2	ND2	ND3	ND3	.0037
0	21	1.1	0.6	0.8	2.7	0.4	4.4	ND2	ND2	N/A
1	21	ND1	ND1	1.0	2.6	ND1	0.1	ND2	ND2	N/A
0	22	ND3	86.3	2680	10300	464	4720	ND3	ND3	≤.002
1	22	ND3	443	6690	33700	ND2	157	ND3	ND3	≤.018
0	23	1.6	1.1	0.3	0.1	ND1	0.03	ND2	ND2	N/A
1	23	ND1	ND1	0.4	1.0	ND1	ND1	ND2	ND2	N/A
0	24	ND3	485	4010	1300	18400	5210	10000	36000	≤.002
1	24	ND3	156	1690	1840	ND3	152	3400	31800	<.0128
0	25	1.9	1.5	0.7	0.5	12.8	0.1	ND2	ND2	N/A
1	25	ND1	0.3	1.1	3.6	ND1	0.3	ND2	ND2	N/A
0	26	ND3	955	11400	30500	1960	11000	ND3	ND3	.011
1	26	ND3	757	8840	29700	ND3	6960	ND3	ND3	.014
0	27	ND3	56.6	871	660	3520	3960	ND3	ND3	.13
1	27	ND2	ND2	359	266	ND2	ND2	ND3	ND3	.029
0	28	2.2	1.4	0.5	0.6	ND1	0.02	ND1	ND1	N/A
1	28	ND1	ND1	0.3	0.6	ND1	ND1	ND2	ND2	N/A
0	29	0.5	3.1	46.4	79.8	5.9	11.3	≤11.1	36.5	≤.004
1	29	ND1	0.2	0.7	2.0	ND1	0.1	ND2	ND2	N/A

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Gulfport, Mississippi Storage Facilities (Continued)
PAGE FOUR

μg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date Code	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
0	30	ND3	170	3530	8790	3190	7180	ND3	ND3	.24
1	30	ND3	119	2610	8770	1080	3480	ND3	ND3	.222
0	31	14.3	19.5	200	698	77.5	18.7	ND2	1.8	≤.002
1	31	2.7	28.6	384	504	10.9	789	ND3	ND3	N/A
0	32	1.0	1.7	1.3	6.2	1.4	8.0	ND2	1.5	N/A
1	32	ND1	0.5	6.7	34.9	ND1	0.2	ND2	ND2	N/A
0	33	1.0	1.3	5.7	3.4	0.4	1.7	ND2	ND2	N/A
1	33	ND1	0.1	0.3	0.7	ND1	0.1	ND2	ND2	N/A
0	34	ND2	21.8	117	494	22.5	34.1	ND2	34.6	<.008
1	34	1.4	0.4	3.3	6.0	ND2	0.1	ND2	ND2	N/A
0	35	ND2	5.8	50.6	175	9.8	29.3	ND2	20.2	≤.34
1	35	ND2	1.0	5.0	15.6	0.5	0.2	ND2	ND2	N/A
0	36	1.3	2.7	23.1	55.8	2.2	2.3	ND2	2.0	≤.010
1	36	ND1	0.3	1.1	3.9	0.1	0.1	ND2	ND2	N/A
0	37	ND3	353	1490	7850	2160	3010	ND3	ND3	≤.008
1	37[d]	ND3	276	1470	5820	ND2	ND2	ND3	ND3	.0218
0	38	ND3	511	1320	6120	36.0	13.2	ND3	ND3	≤.011
1	38	ND3	275	859	4160	ND2	ND2	ND3	ND3	.0242
0	39	1.2	7.8	6.1	15.6	29.0	43.2	8.0	18.5	≤.040
1	39	ND1	0.1	0.5	2.2	0.1	0.1	ND2	2.5	N/A
0	40	3.6	6.1	40.8	128	7.8	22.0	ND2	ND2	≤.003
1	40	ND1	0.1	0.3	0.7	ND1	ND1	ND2	ND2	N/A

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Gulfport, Mississippi Storage Facilities (Continued)

μg/g

		IMPURITIES		HYDROLYSIS PRODUCTS		HERBICIDE ORGANGE COMPONENTS				
Sample Date Code[a]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
0	41	259	354	5030	6800	10200	11500	<600	<800	.23
1	41	ND3	185	5790	13900	2130	868	ND3	ND3	.251
0	42	2.1	1.1	0.6	2.5	0.2	ND1	ND2	ND2	N/A
1	42	ND1	ND1	0.1	0.3	ND1	ND1	ND2	ND2	N/A
0	43	ND1	1.4	9.2	15.7	0.5	2.6	≤2.0	2.5	≤.043
1	43[d]	ND3	70.1	2270	6860	ND2	ND2	ND3	ND3	.0059
0	44	ND1	0.8	12.0	30.5	0.5	5.0	ND2	ND2	N/A
1	44[d]	ND3	29.2	3510	7470	ND2	ND2	ND3	ND3	.0091

[a] Sample Date Code: 9 - 28 July 1977
0 - January 1978
1 - 6 November 1978
2 - 14 June 1979

[b] ND - none detected: ND1 - lower limit of detectability of 0.1 μg/g
ND2 - lower limit of detectability of 1.0 μg/g
ND3 - lower limit of detectability of 100 μg/g

[c] not analyzed

[d] Soil depth study - samples from Gulfpo
site 37 on November 6, 1978:
1-37 from 0"- 1" soil depth layer
1-43 from 1"- 2" soil depth layer
1-44 from 2"- 3" soil depth layer

TABLE 2

SUMMARY OF ANALYTICAL RESULTS FOR HERBICIDE ORANGE, ITS HYDROLYSIS PRODUCTS AND TCDD

IN THE JOHNSTON ISLAND STORAGE FACILITIES

µg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date Code[a]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
9	01	ND1[b]	0.4	10.1	10.8	ND1	ND1	ND2	ND2	N/A[c]
0	01	ND1	1.3	0.8	0.1	ND1	ND1	ND2	ND2	N/A
1	01	ND1	0.1	3.0	4.0	0.1	0.3	2.2	6.4	N/A
9	02	5.4	0.3	12.0	18.0	ND1	0.1	ND2	ND2	N/A
0	02	ND1	0.8	2.8	0.7	0.2	1.8	ND2	0.5	N/A
1	02	ND1	0.1	1.0	2.0	ND1	0.1	0.9	2.5	N/A
9	03	ND1	ND1	0.7	7.6	ND1	ND1	ND2	ND2	N/A
0	03	ND1	0.7	3.3	0.6	0.1	0.3	ND2	ND2	N/A
1	03	ND1	0.1	0.2	0.4	ND1	0.03	0.1	0.5	N/A
9	04	ND1	0.3	14.4	29.3	ND1	0.2	ND2	ND2	N/A
0	04	ND1	1.7	5.6	0.1	0.5	1.3	ND2	ND2	N/A
1	04	ND1	ND1	0.2	0.4	0.2	ND1	0.1	0.5	N/A
9	05	ND3	93.0	12600	8750	4230	12500	ND3	ND3	.0330
0	05	ND3	123	11800	10200	1980	13800	≤600	~600	.0340
1	05	ND3	34.2	7930	22000	ND3	1510	ND3	ND3	.0191
2	05	ND3	ND2	971	2590	ND3	ND3	ND3	ND3	.041
9	06	ND3	63.5	4720	638	31200	10300	7900	30600	≤.065
0	06	ND3	255	6050	1720	10400	7630	~15000	32000	≤.006
1	06	ND3	136	17600	10900	ND3	143	1800	11300	.0076
9	07	ND2	32.7	1980	1250	6600	6790	520	424	.0113
0	07	6.8	14.1	1970	1670	25.2	197	910	340	.007
1	07	1.6	7.2	944	628	8.0	29.9	23.2	121	.0082

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Johnston Island Storage Facilities (Continued)
PAGE TWO

μg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date Code[a]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
9	08	ND2	13.2	1520	525	ND1	211	ND3	1270	.0046
0	08	ND1	2.3	1.7	2.0	ND1	0.5	2.0	7.8	N/A
1	08	ND1	ND1	0.1	0.2	0.1	0.1	0.1	0.4	N/A
9	09	ND3	205	1370	1390	22100	19100	5140	3170	.0417
0	09	ND3	181	7800	5790	21400	21100	9000	5000	.022
1	09	ND3	111	15700	11500	14700	12300	3900	2430	.0286
2	09	ND3	149	15500	15600	2240	4440	3480	2970	.053
9	10	ND3	460	42600	45600	24600	19800	≤1600	1050	.196
0	10	ND3	477	31100	46600	23300	27300	~9000	~4000	.230
1	10	ND3	456	38700	61000	27100	25900	~4000	~3000	.235
2	10	ND3	136	21200	26400	100	83.8	~520	~360	.13
9	11	ND3	34.9	4080	3650	24400	24500	≤560	330	.0534
0	11	ND1	1.9	2.1	3.6	0.9	6.2	7.2	9.4	≤.0025
1	11	0.1	0.6	5.0	38.5	0.8	4.3	6.3	10.1	≤.0038
9	12	ND3	172	1560	1370	32800	33500	ND3	~300	.178
0	12	ND3	110	2300	1200	26200	27300	ND3	ND3	.080
1	12	ND3	46.6	13200	18200	7150	4290	ND3	ND3	.111
2	12	ND3	53.6	6530	8680	817	1900	≤400	100	.081
0	13	ND2	11.2	23.9	23.7	ND2	1.0	ND2	ND2	≤.0003
1	13	ND1	ND1	ND1	0.1	ND1	ND1	ND1	0.2	N/A
0	14	ND1	0.8	4.4	0.6	0.2	1.0	ND2	1.2	N/A
1	14	ND1	ND1	0.1	0.3	0.1	0.2	0.4	0.6	N/A
0	15	ND1	1.5	3.8	ND1	ND1	ND1	ND1	ND1	N/A
1	15	ND1	ND1	0.1	0.3	ND1	ND1	0.1	0.2	N/A

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Johnston Island Storage Facilities (Continued)
PAGE THREE

μg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date Code[a]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
0	16	ND1	1.5	1.2	0.1	ND1	0.1	ND1	ND1	N/A
1	16	ND1	ND1	0.1	0.1	ND1	ND1	0.1	0.2	N/A
0	17	ND2	12.5	5.8	6.8	ND2	ND1	ND2	ND2	N/A
1	17	ND1	0.1	0.1	0.3	ND1	0.1	0.1	0.2	N/A
0	18	ND2	11.1	691	2920	28.8	57.2	13.1	46.0	.001
1	18	ND2	0.4	2.0	4.9	0.7	1.5	ND2	ND2	<.0014
0	19	ND1	1.4	1.3	0.2	0.1	0.2	ND2	ND2	N/A
1	19	ND1	ND1	ND1	0.2	ND1	ND1	0.1	0.1	N/A
0	20	ND1	1.3	4.7	0.1	ND1	ND1	ND1	0.1	N/A
1	20	ND1	ND1	ND1	0.1	ND1	ND1	0.1	0.1	N/A
0	21	ND1	1.4	1.0	0.3	ND1	ND1	ND1	ND1	N/A
1	21	ND1	ND1	ND1	0.1	ND1	0.1	0.1	0.2	N/A
0	22	ND1	0.1	0.6	0.2	ND1	ND1	ND1	ND1	N/A
1	22	ND1	0.2	3.9	8.8	1.9	2.4	1.6	1.5	N/A
0	23	ND2	9.0	47.6	23.4	ND2	3.4	ND2	ND2	≤.0006
1	23	ND1	0.1	0.9	2.4	0.4	3.7	0.4	0.4	N/A
0	24	ND3	206	3440	2130	24500	22000	~9000	8000	.025
1	24	ND3	81.3	9690	12100	ND3	646	~500	~2000	.024
2	24	ND3	125	19500	20600	ND3	341	2900	3100	.064
0	25	ND2	4.2	6.0	4.6	ND2	1.2	ND2	2.7	N/A
1	25	0.1	1.8	20.6	38.1	11.0	36.9	34.3	27.2	N/A

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Johnston Island Storage Facilities (Continued)
PAGE FOUR

μg/g

		IMPURITIES		HYDROLYSIS PRODUCTS		HERBICIDE ORANGE COMPONENTS				
Sample Date Code[a]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
0	26	ND2	3.8	45.3	88.6	2.2	18.6	≤10	≤20	.010
1	26	ND2	0.2	1.0	6.1	0.2	0.4	1.4	1.4	.003
2	26	ND3	8.0	245	256	ND3	ND3	ND3	ND3	.011
0	27	ND2	3.2	3.1	1.5	0.5	0.5	ND2	ND2	≤.0002
1	27	ND1	0.1	0.5	5.0	0.1	1.1	0.8	0.6	N/A
0	28	ND3	31.8	26800	38800	ND3	316	ND3	ND3	.0002
1	28	ND3	14.3	9010	13200	ND3	461	ND3	ND3	<.0009
0	29	0.7	4.0	13.6	62.8	18.1	69.7	6.2	11.7	.0008
1	29	ND2	0.1	0.2	0.6	ND2	ND1	ND2	1.0	N/A
0	30	ND3	45.1	4480	2600	6980	11800	1400	500	.038
1	30	ND3	22.2	3170	4760	2400	2250	ND3	ND3	.036
2	30	ND3	20.0	708	3270	193	563	340	97	.040
0	31	ND2	4.5	71.8	303	2.3	21.3	≤17	19.9	.002
1	31	ND2	0.3	0.9	6.6	0.5	0.4	1.2	0.5	<.0014
0	32	ND3	138	18800	17700	3590	7680	ND3	ND3	.0007
1	32	ND3	18.8	10100	20100	ND2	ND2	ND3	ND3	≤.0023
0	33	ND1	0.6	13.8	0.4	0.3	1.3	1.1	0.4	N/A
1	33	1.4	27.1	197	151	60.7	4.9	1.3	1.4	N/A
0	34	ND3	23.9	2280	2080	81.5	583	ND3	ND3	.029
1	34	ND3	27.7	3240	7770	ND3	133	ND3	ND3	.152
2	34	ND3	32.0	2970	9130	ND3	10.1	ND3	ND3	.15
0	35	ND3	99.0	16500	14700	350	350	~6000	12000	.008
1	35	ND3	82.5	23400	26100	ND3	444	~4000	~28000	≤.0056

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Johnston Island Storage Facilities (Continued)
PAGE FIVE

μg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date Code[a]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
0	36	ND3	150	15300	10500	37100	44800	ND3	ND3	.015
1	36	ND3	61.1	14200	29900	ND3	841	ND3	ND3	.019
2	36	ND3	179	29200	36600	1040	8570	ND3	ND3	.074
0	37	ND3	223	10800	10800	21000	30200	ND3	ND3	.074
1	37	ND3	113	19900	20600	12300	11900	ND3	ND3	.094
2	37	ND3	81.7	10900	11000	402	1170	≤200	≤500	.14
0	38	ND3	169	2780	1230	8630	7350	22000	14000	.006
1	38	ND3	134	12900	7840	ND3	1640	~10000	10000	≤.0018
0	39	ND3	38.8	1740	1370	6380	10200	ND3	ND3	.029
1	39	ND3	30.4	1640	2290	1960	2250	ND3	ND3	.041
2	39	ND3	7.9	492	1530	ND3	24.7	ND3	ND3	.050
0	40	ND3	236	11400	9350	31700	29700	13000	5000	.055
1	40	ND3	120	21900	21900	10100	6330	~1000	~2000	.053
2	40	ND3	116	13000	12900	635	1940	2700	2700	.084
0	41	ND3	280	11900	10600	25100	32600	5000	~2200	.085
1	41	ND3	143	26900	29700	10200	5850	~300	~800	.127
2	41	ND3	183	36300	38700	1990	5840	~1000	900	.12
0	42[d]	ND3	274	2470	5050	16700	17600	~13000	~5000	.025
1	42	ND3	98.7	5460	3930	4430	4390	~1500	~1500	.020
2	42	ND3	108	2650	3330	1060	2600	-2000	~1900	.021
0	43[d]	ND1	0.1	0.5	0.5	ND1	ND1	ND2	ND2	≤.0001
0	44	ND1	0.4	2.4	23.9	0.4	1.6	ND2	ND2	N/A

Summary of Analytical Results for Herbicide Orange, *Its Hydrolysis Products and TCDD in the Johnston Island* Storage Facilities (Continued)
PAGE SIX

μg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date Code[a]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
0	45	ND1	0.1	0.5	2.5	0.1	0.6	ND2	ND2	N/A
0	46[d]	ND3	203	2830	2170	17800	16100	6000	4000	.024
0	47[d]	5.8	10.6	574	25.9	10.2	ND1	ND2	ND2	≤.0002
0	48[d]	ND1	0.3	1.2	0.4	ND1	ND1	ND2	ND2	≤.0002

[a] Sample Date Code: 9 - 25 August 1977
0 - January 1978
1 - 18 October 1978
2 - 8 August 1979

[b] ND - none detected: ND1 - lower limit of detectability of 0.1 μg/g
ND2 - lower limit of detectability of 1.0 μg/g
ND3 - lower limit of detectability of 100 μg/g

[c] N/A - not analyzed

[d] Soil depth studies done on Johnston Island sites 42 and 46 in January 1978:

0-42 from 0-8 cm depth at site 42
0-43 from 8-16 cm depth at site 4
0-46 from 0-15 cm depth at site 4
0-47 from 15-30 cm depth at site
0-48 from 30-45 cm depth at site

TABLE 3

PESTICIDE ANALYSIS RESULTS OF PENETRATION STUDY SOIL SAMPLES TAKEN FROM GULFPORT, MISSISSIPPI SITE NO. 17 ON 14 JUNE 1979

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample No.[a]	Sample Depth (cm)	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
1	0-2	ND3[b]	282	17300	46900	ND3	86.2	ND3	ND3	.48
5	2-4	199	945	67800	62300	268	5940	ND3	ND3	.51
4	4-6	ND3	114	13500	12200	ND3	260	ND3	ND3	.15
2	6-8	ND3	118	9540	10200	ND3	319	ND3	ND3	.16
3	8-12	ND3	129	20500	16500	494	668	ND3	ND3	.30
10	12-16	ND3	59.6	17400	13800	ND3	9.5	ND3	ND3	.38
9	16-20	19.7	29.4	1070	1020	2.2	10.2	ND2	ND2	.0302
11	20-24	18.0	28.0	640	493	0.8	5.1	ND2	ND2	.0116
8	24-39	3.3	8.0	273	49.4	0.2	0.9	ND2	ND2	<.00048
6	39-55	0.8	1.1	61.3	71.9	1.6	3.6	ND2	ND2	.00148
7	55-70	1.0	0.8	39.9	39.3	0.4	1.0	ND2	ND2	.00078

[a] The sample numbers refer to labelling as originally sent to the FRC for "blind" analysis. The actual sample depths were obtained from Major Young for preparation of this table after the completion of the analysis.

[b] ND - none detected:

ND1 - lower limit of detectability of 0.1 μg/g
ND2 - lower limit of detectability of 1.0 μg/g
ND3 - lower limit of detectability of 100 μg/g

TABLE 4

PESTICIDE ANALYSIS RESULTS OF PENETRATION STUDY CORAL SAMPLES TAKEN FROM JOHNSTON ISLAND SITES NO. 10 AND NO. 37 ON 8 AUGUST 1979.

μg/g

Sample Depth (cm)	Dichlorophenol	Trichlorophenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
Site #10									
0-2	ND3[a]	120	29200	30200	65.1	257	590	500	.067
2-4	ND3	243	24900	31400	57.9	38.0	630	680	.14
4-6	ND3	115	15200	24100	36.5	19.4	630	220	.17
6-8	ND3	68.0	15600	20100	239	21.4	≤240	50	.10
8-12	ND3	44.3	7220	9800	119	37.2	64	22	.042
12-16	ND3	43.6	9930	13600	182	131	60	12	.045
16-20	ND3	52.8	10100	12900	240	398	57	47	.055
20-24	ND3	60.1	9410	10500	364	1020	51	84	.042
Site #37									
0-2	ND3	133	17700	22300	681	2530	280	640	.14
2-4	ND3	108	13500	11500	355	1310	290	840	.14
4-6	ND3	75.5	9570	7290	210	826	300	430	.135
6-8	ND3	10.5	2670	2990	360	17.6	64	210	.049
8-12	ND3	7.9	638	646	ND3	ND2	ND3	ND3	.015
12-16	ND3	7.0	130	230	ND3	ND2	ND3	ND3	.006
16-20	ND3	7.2	286	695	ND3	11.0	ND3	ND3	.011
20-24	ND3	7.9	66.2	138	ND3	ND2	ND3	ND3	.005

[a] ND - none detected

ND1 - lower limit of detectability of 0.1 μg/g
ND2 - lower limit of detectability of 1.0 μg/g
ND3 - lower limit of detectability of 100 μg/g

TABLE 5

PESTICIDE ANALYSIS RESULTS OF SEDIMENT SAMPLES TAKEN FROM GULFPORT, MISSISSIPPI STORAGE FACILITIES 14 JUNE 1979

µg/g

Sediment Sample No.	Dichlorophenol	Trichlorophenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD (ppb)
1	ND1[a]	0.01	1.2	0.9	ND1	ND1	ND1	ND1	<2
2	ND1	0.2	1.0	2.1	ND1	0.03	ND1	ND1	3.6
3	ND1	0.1	1.2	2.7	ND1	0.2	ND1	ND1	<2
4	0.2	0.07	0.4	0.7	ND1	0.1	ND1	ND1	<2
5	ND1	0.04	0.6	0.5	0.1	0.5	ND1	ND1	<2
6	0.1	0.05	0.4	0.4	ND1	0.02	ND1	ND1	<37
7	ND1	0.02	0.2	0.2	ND1	0.04	ND1	ND1	<2
8	ND1	0.08	0.3	0.6	ND1	0.06	ND1	ND1	2.7
9	ND1	ND1	0.2	0.1	ND1	ND1	ND1	ND1	<0.5
10	ND1	0.01	0.1	0.03	ND1	ND1	ND1	ND1	<2
11	ND1	0.04	0.2	0.05	ND1	ND1	ND1	ND1	<2
12	ND1	0.03	0.1	0.02	ND1	ND1	ND1	ND1	<0.5
13	ND1	0.03	0.2	0.1	ND1	ND1	ND1	ND1	<0.5

[a] ND1 - none detected, lower limit of detectability of 0.1 µg/g.

TABLE 6

PESTICIDE ANALYSIS RESULTS OF OCEAN FLOOR SEDIMENT SAMPLES AND CONTROL SOIL SAMPLES FROM JOHNSTON ISLAND AND LABORATORY BLANKS. THE SEDIMENT SAMPLES WERE TAKEN ON 7 AUGUST 1979 AND THE CONTROL SAMPLES FROM SAND ISLAND AND NORTH ISLAND WERE TAKEN IN OCTOBER 1978.

µg/g

Sample	Dichlorophenol	Trichlorophenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
JISED-1	0.13	0.03	1.4	2.1	ND1[a]	ND1	<0.02	<0.04	≤.0005
JISED-2	0.07	0.03	0.2	0.2	ND1	0.01	<0.01	<0.1	≤.001
SAND IS.	ND1	0.02	0.11	0.06	ND1	0.01	ND1	ND1	N/A[b]
NORTH IS.	ND1	0.09	ND1	0.09	ND1	0.02	ND1	ND1	N/A
BLANK-1	ND1	ND1	0.2	0.02	ND1	ND1	ND1	ND1	
BLANK-2	ND1	ND1	0.3	0.07	ND1	0.02	ND1	ND1	

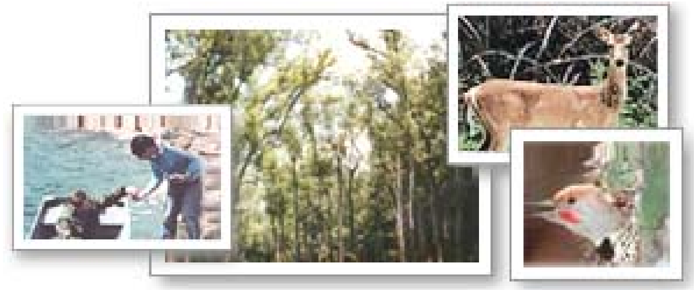
[a] ND1 - none detected, lower limit of detectability of 0.1 µg/g.
[b] N/A - not analyzed.

U.S. Fish & Wildlife Service

Johnston Island
National Wildlife Refuge

717 nautical miles west-southwest of
Honolulu, HI 96850 - 5167
E-mail: Don_Palawski@fws.gov
Phone Number: 808-421-0011

Visit the Refuge's Web Site:
http://pacificislands.fws.gov/wnwr/pjohnsnwr.html



Overview

Johnston Island National Wildlife Refuge
Johnston Atoll National Wildlife Refuge is located in the central Pacific Ocean, 717 nautical miles west-southwest of Honolulu. The refuge is managed for 14 species of breeding sea birds and 5 species of wintering shorebirds, and for its coral reef and diverse marine organisms, including the threatened green sea turtle.

The atoll comprises four small islands (696 acres), which constitute the only land area in over 800,000 square miles of ocean. The emergent land associated with this refuge provides critical, rat-free habitat for central Pacific sea bird populations; its coral reef ecosystem is an important marine resource.

The refuge was created by Executive Order 4467 in 1926; there has been a military presence on the atoll since 1934. It served as a refueling point for U.S. aircraft and submarines in World War II and as a base for airlift operations during the Korean War. The U.S. Air Force is the current host management agency and has operational control of the atoll.

The infrastructure has grown to support the workforces necessary for various military missions; approximately 1,300 people live and work at Johnston Atoll. The military mission is almost complete, numerous closure and cleanup issues are being discussed, and the atoll will ultimately be returned to the U.S. Fish and Wildlife Service.

Getting There . . .
The island is closed to public access.

Alert !

The refuge is closed to the public.

Recreation & Education Opportunities

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Management Activities

The U.S. Air Force is the current host management agency with ultimate operational control of the atoll. The Department of Defense manages the infrastructure and military mission on Johnston Island, while the U.S. Fish and Wildlife Service manages natural resources on all four islands and the surrounding coral reef.

The refuge is managed primarily as a breeding ground for seabirds and a wintering grounds for shorebirds. Twelve species of seabirds, such as the great frigatebird and wedge-tailed shearwater, breed within the atoll. Also common are hosts of petrels, boobies, and noddies. The reef community in the lagoon supports diverse marine life including the threatened green sea turtle and endangered Hawaiian monk seal. The staff manages year-round monitoring programs for 14 species of seabirds and 5 species of

Wildlife and Habitat

Formation of Johnston Atoll began about 70 million years ago, when submarine volcanic eruptions built up layer upon layer of basaltic lava from the floor of the ocean to its surface. Over millions of years, the island slowly eroded and subsided. As the island sank beneath the surface of the ocean, corals around its fringes continued to grow.

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migratory shorebirds.

Several significant contaminant issues exist: closure of the chemical weapons disposal plant; dioxin (Agent Orange), which contaminates at least four acres of land and has migrated to the marine environment; plutonium from two abortive missile launches during high-altitude nuclear and missile testing in the 1950s and 1960s; and a subsurface plume of PCB-contaminated petroleum product.

Contaminants tracking involves monitoring seabirds, fishes, and marine invertebrates. Refuge personnel also monitor fish populations and threatened green sea turtles, which use the waters of Johnston Atoll as an important foraging location. Also, soil and sediment samples are used to establish the degree and extent of contamination.

EPA Collusion with Industry

A Very Brief Overview

Liane C. Casten / Synthesis/Regeneration 7-8 Summer 1995

[This Issue Table of Contents at Greens Website]

Liane C. Casten is the Environmental Task Force Chair of Chicago Media Watch

The following is testimony to the US Environmental Protection Agency (EPA) presented at its hearing of December 14, 1994, concerning the reassessment of dioxin. —Editor

I'm here to say that notwithstanding the power of the EPA's dioxin reassessment, the agency all along has known about dioxin's toxic properties, and has done just about everything it could to keep the general public in the dark. In fact, the EPA has worked aggressively with industry in order to protect those large polluting corporations while those corporations keep spewing out dioxin in their manufacturing processes or products.

Synthesis/Regeneration *is a journal of debate on social and political matters of interest to Greens and a resource for Green and allied organizers working on technological, environmental, trade and other issues, and on Green Party organization-building. We invite articles from all Green perspectives.*

The early cover-up was successful. As a result, the health consequences to this country are serious. Dioxin is everywhere. *The EPA has been part of the problem, not part of the solution, because the EPA would not take action on this political chemical*—and still may not, even after the 1994 reassessment. Actions are now political.

Both the federal government and industry have waged a successful war to obscure the known seriousness of dioxin as a contaminant in both Agent Orange and in the present careless manufacture of dioxin through industrial processes. After the Vietnam War the issue was product liability and veterans compensation. The issues now are pretty much the same thing. EPA's big goal has been to protect industry.

Let's review some of EPA's cover-up activities:

1965. Dow Chemical conducted a series of dioxin experiments on prisoners incarcerated in Holmsberg Prison, PA. Under the direction of V. K. Rowe of Dow, Dr. Albert Kligman was given $10,000 to conduct his experiments—putting a specific amount of pure dioxin on the backs of these human guinea pigs. Dr. Kligman even increased the dosage dramatically at one point, without Dow's knowledge. This is important for two reasons: After the prisoners were released, some came to the EPA for help. They were quite sick.

The EPA rejected their claims and "lost" their files—even though major testimony about these experiments came to light in 1980 EPA hearings. Mr. Rowe testified about them. No moral outrage here. Rowe refused to follow up on the state of these prisoners, would not conduct anything close to a medical exam, and the matter was dropped.

The result? Dow Chemical could continue to claim that "Beyond a case of chloracne, there is nothing wrong with anyone exposed to Agent Orange." The EPA blew a powerful opportunity to check on a controlled body of men with known exposure—and didn't.

1978. When the Department of Defense decided there was no legitimate domestic use for Agent Orange, they decided to burn thousands of barrels left over from the war at sea off Johnson Island, a Pacific atoll. Enter the EPA with major advice for taking care of the personnel on board the incineration ship, *Vulcanus*. Agent Orange was burned there at 1,000 degrees C. The EPA 1978 manual said:

The highly toxic contaminant present in Herbicide Orange is 2,3,7,8-tetrachlorodibenzo-p-dioxin. The US Air Force has analyzed Herbicide Orange stocks and found TCDD concentrations ranging from 0.05 to 47 ppm [parts per million]. Times Beach was evacuated at 2 ppb—parts per billion. Pooled stocks would have an estimated average TCDD concentration of 1.9 ppm.

The principal Herbicide Orange constituent of concern, TCDD, has been found to be highly embryotoxic, teratogenic (tending to cause developmental malfunctions and monstrosities,) and acnegenic and is lethal in the microgram-per-kilogram of body weight range [emphasis added].

The effects observed on workers are summarized below—to emphasize the need for personnel hygiene:

- chloracne (moderate to severe skin irritation, with swelling, hardening, blackheads, pustules and pimples;
- hyperpigmentation (skin discoloration);
- muscular pain;
- decreased libido, fatigue, nervous irritability, intolerance to cold, destruction of nerve fibers and nerve sheaths.

In addition, effects on exposed test animals...may be considered possible effects on the human system, especially when the metabolism of the animal is similar to that of man. These effects include toxicity to embryos, birth defects, possible carcinogenity and even death. It should also be noted that the greatest hazard is to pregnant females and their fetuses, especially in the first third of the pregnancy period.

The manual then spoke of the ways of "entry of TCDD into the body: through mouth—ingestion; through the skin—percutaneous; through the lungs and eyes."

If this weren't enough, the manual was put together with the cooperation of Dow Chemical's Rowe, who had been Dow's point man in telling all the customers that there were no problems with their herbicides while secretly writing to all Dow management that TCDD is "the most toxic material we've ever studied." Add the Department of Defense and the US Air Force Environmental Health Labs to the committee.

The manual then goes on to describe in great detail just what kind of precautions the workers on board the *Vulcanus* must take to ensure safety and then what to do should a worker become exposed: "Decontaminate him immediately; speed is essential."

1978. Local (Michigan) representatives informed FDA's Detroit District that they had presumptively detected dioxins in the Tittabawasse and Saginaw Rivers, which take the outflow from Dow. EPA estimated about 300 ppt (parts per trillion, very high!) total dioxin in the river water. EPA obtained 21 fish samples from the Michigan Department of Natural Resources, taken from both rivers. They found high levels of TCDD, from 11 to 153 ppt, and did nothing about their findings.

1979. EPA's Mike Dellargo wrote a scathing report on the evils of dioxin, identifying most of what the 1994 official version finally admitted. Dellargo wrote his 60-page analysis as a rebuttal to Dow Chemical's lies. He analyzed their claims and then found the holes. But the public spotlight was not on the EPA then, and Dellargo's report was shelved. Here are a few snippets—not at all dissimilar to the 1994 findings:

- TCDD is 10 times more potent than the potent human carcinogen aflatoxin.
- TCDD is a complete carcinogen when applied to the skin...TCDD was acting as a "potent promoter of neoplastic changes." This led to the wide variety of tumors to be associated with low dose levels in the diet.
- Fetotoxic and embryolethal effects have been reported in studies, using low-dose regimens of TCDD. Impairment of reproduction was clearly evident among rats...Fetal effects have routinely been observed in mammalian species at doses where the mothers appear to be perfectly normal.
- TCDD is one of the most potent known teratogens (causing birth defects). Increased incidence of early spontaneous abortions and reproductive difficulties. The significance of these results in nonhuman primates should not be underestimated because of the close similarities between the reproductive systems of humans and monkeys.

- This combination of high toxicity and significant exposure clearly results in significant risk potential for people who are exposed to TCDD-containing herbicides.
- Milk and beef are a serious source of TCDD contamination. (Just like the 1994 version. Lots of eating has gone on between 1979 and 1994. By 1991, the entire food supply, especially animal products, contained so much dioxin that the average American ingests from 150 to 500 times EPA's "acceptable" dose on a daily basis. A single meal of Great Lakes fish can contain the "acceptable" dioxin dose for an entire year.)

1980. EPA held suspension/cancellation hearings on 2,4,5,T. The agency heard expert testimony from an enormous variety of scientific experts—all stating variations of the same thing: dioxin is a very dangerous substance. The hearings came about because of the large-scale miscarriages in Alsea, Oregon after the Forest Service sprayed the forests. Dow was able to keep key scientists from testifying—especially Dr. Ralph Dougherty, who had shown chromosomal damage in the sperm of returning Vietnam vets. The result: a suspension, not a complete cancellation.

However, it's been reported that EPA officials had concealed evidence conclusively linking dioxin to miscar-riages and had forbidden its scientists to discuss the project with the public or the media. Within two months after the suppressed link came to light, EPA began an internal investigation.

Dow "voluntarily" withdrew its opposition to the ban on 2,4,5,T, and EPA quietly canceled the herbicide's registration without having to ratify a "no safe level" position. *(There is no safe level.)* Dow could then continue to lie about the level at which TCDD is "safe" and sell 2,4,5,T to Third World countries—the Circle of Poison.

1980. Monsanto released the first of three studies of workers exposed to dioxin at its 2,4,5,T factory in West Virginia. The studies found that the workers suffered no dioxin-related effects except for chloracne—the disease which Dow admitted publicly was possible, but which they admitted privately meant the whole body was affected: systemic poisoning. The Monsanto research laid the foundation for claims that humans were somehow immune to the toxicity of dioxin. They were touted as the most comprehensive studies to date concerning dioxin's human health effects. Vietnam veterans were not to be compensated. And the media loved it. Soon it became accepted wisdom; dioxin has never caused a single death.

1981. Under the corrupting eye of Reagan appointee Anne Gorsuch Burford, EPA, with now "resigned" John Todhunter and John Hernandez, forced Region 5 (in Chicago) to delete all references to Dow as well as any discussion of health risks posed by eating Great Lakes fish in a major report written by Milt Clark. Also deleted were all mentions of other studies pointing to dioxin's toxicity, including miscarriages in Oregon. The report was written to identify the source of Great Lakes continued pollution. The first draft concluded that dioxin in the Great Lakes constituted a grave cancer threat to persons eating fish from the lakes. The report named Dow as the primary dioxin source and recommended that consumption of fish caught in the region of Dow's Michigan plant "be prohibited." The edited version alone went public—after Dow edited it.

1983. "EPA CALLS DIOXIN MOST POTENT MATERIAL." So goes the 1983 headline in the *St. Louis Post Dispatch*. The story continues with the fact that EPA scientists have concluded that dioxin, found in the air, water and soil, is the most potent substance they have ever studied. It presents an unacceptable cancer risk when found in water in parts per quadrillion. The story disappeared after two days.

1990. It turns out that the three Monsanto studies were cooked, manipulated. Who found this out? Cate Jenkins, Ph.D., EPA chemist who analyzed data made available through discovery at an exposure liability trial in Missouri. Both the cancer victims and the controls were mixed together in the Monsanto studies, diluting the conclusions. Also, Monsanto had knowingly omitted five deaths from the exposed study group. Jenkins stated that Monsanto "deliberately and knowingly" used false data in their study." Under extensive cross examination during the trial, Dr. George Roush, Medical Director of Monsanto, actually admitted that the conclusions of the three studies were "incorrect."

Jenkins brought her analysis to the attention of the National Enforcement Investigations Center of EPA's Office of Criminal Investigations and demanded that the agency investigate. She took great pains to identify the impact of these falsified human studies on EPA dioxin regulations and carefully explained just where the studies were faked. Big mistake. Instead of thanks, in April 1992 the EPA removed Jenkins from her job and transferred her to an isolated position which prevented her from having any contact with the public or industry. EPA also informed her that as a result of the transfer, she would no longer be permitted to write new hazardous waste regulations. She was on payroll to do nothing.

1986. Comes the PR about dioxin. "It's not as toxic as we once thought." These conclusions were developed by EPA's controversial "Dioxin Update Committee," basically leading the public into a false state of complacency. The dioxin committee was put together by Pesticides and Toxics Office Chief Jack Moore—a prominent player in keeping the truth about dioxin from the public. As far as I know, Moore now co-heads the chlorine industry-backed panel to investigate the soundness of the "source" of numbers and methodology EPA used to compute its estimates for dioxin.

Back then EPA administrator Lee Thomas had requested that the agency staff develop a consensus on the issue in light of new studies suggesting lower risks to public health than shown in a number of earlier studies. Considering the mounting evidence of dioxin's toxicity, the only question is, "What new studies?"

The panel came under serious criticism because of a perceived industry bias and the closed door nature of the review. Despite the fact that the National Cancer Institute had published a major study that year about dioxin's ability to compromise the immune system, and despite additional internal data in EPA files about the compromised immune system, the panel said, the jury is still out.

It was pointed out that no known environmentalists were appointed to the review, and Moore's findings circulated throughout the agency.

1986 to present: A deliberate, orchestrated effort, sanctioned by the Reagan/Bush White House and led by the Center for Disease Control and Vernon Houk to suggest that there is little in dioxin to worry about. Before he died of cancer, Houk was seen running around the country lying. The EPA was silent, even though by 1992, its first draft of dioxin reassessment was published, showing on a preliminary level, just what the final 1994 draft concludes.

The EPA, now under public scrutiny, is forced to admit publicly *what the agency has known all along*. Taking orders from each consecutive White House, the EPA was forced, over the years, to ignore the growing body of incriminating scientific data because dioxin is more than a chemical; it's always been a political hot potato.

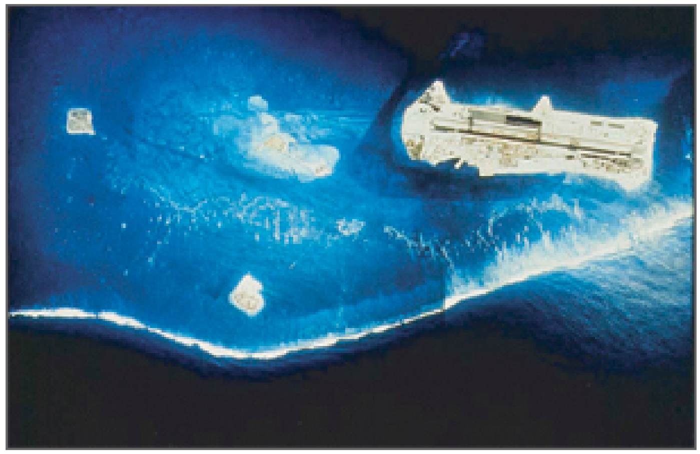
Finally, however, in 1994, EPA scientist had some "answers." And the spotlight is on them. Thirty years of pain, catalogued through personal testimony and hundreds of independent studies (there's a whole bibliography here) have been verified by the "official" science.

Because so many within the regulatory agency who were connected to dioxin held to such a corrupt set of priorities, had broken their own laws, really, what this country has now—some 30 years after the Vietnam War—is unregulated dioxin contamination. The silence and cover-ups led to a nation at risk. The EPA is the problem because of its tight connection to polluting industries. The only important question now is, "Will the agency start dealing with the industrial uses of chlorine, and, if so, how long will it take?

I have no illusions about EPA anymore. The Chlorine Chemical Council is gearing up for a fight; industry has allocated millions of dollars to protect its plastics and other dioxin-contaminated products, and, thanks to industry-hired public relations guns, the public will be very confused. Industry will quibble with the 1994 reassessment—with the science, with the methodology—and succeed in gaining delays. That's part of industry strategy.

As a citizen, I fear the Industrial Protection Agency will continue to bow to the wishes of industry and the nation and its children will suffer profoundly. No wonder citizens are turned off by government. Government has failed us. We live in fear.

source: http://www.greens.org/s-r/078/07-47.html 18jul01



JOHNSTON ATOLL DECOMMISSIONING

Client
U.S. Air Force / CH2M Hill

Location
Johnston Atoll, South Pacific

Duration
2002–2004

Services
Environmental Cleanup
Demolition
Thermal Treatment

Project Description

Parsons completed this project to decommission the former nuclear weapons test site and nerve agent storage facility that formerly housed Agent Orange, as well as other products and by-products. Located 715 nautical miles west-southwest of Hawaii, the Atoll was successfully decommissioned and environmentally restored to become a bird sanctuary. Parsons completed five projects on Johnston Atoll.

Excavation / Demolition of Outer Islands

This project consisted of demolishing the majority of the existing structures on North and East islands (in support of upcoming soil thermal treatment), as well as a 570,000-gal fuel storage tank and other ancillary structures. The contract also entailed excavating, transporting, and stockpiling 15,000 tons of soil contaminated with Agent Orange and 15,000 tons of soil contaminated with polychlorinated biphenyls (PCBs) and/or heavy oils. Incidental to this work was recovering floating product (fuel oil) from groundwater, mobilizing a wastewater treatment plant, asbestos and lead abatement, tank cleaning and decommissioning, backfilling, and site restoration.

Another component to this project was the demolition, decommissioning, and “bird safing” of structures on Sand, North, and East Islands—all of which are within Johnston Atoll. To make the area safe for birds, Parsons decommissioned buildings by removing physical hazards (pointed and sharp objects, debris, glass, fence posts, fabrics, and other such hazards), as well as removing and/or mitigating entrapment hazards. On Sand Island, the work involved demolishing structures and bird safing activities. On North and East Islands, the work involved decommissioning and bird safing of structures (the structures on these two islands were not demolished).

Thermal Treatment

The contaminated soil that was excavated for the Outer Islands project required thermal treatment. For this contract, Parsons treated the excavated 15,000 tons of soil contaminated with Agent Orange and 15,000 tons of soil contaminated with PCBs and/or heavy oils. The thermal treatment included screening of all soil and briquetting the fine-particle soil prior to treatment. This contract also required that Parsons put into operation an extensive air emission treatment system along with a wastewater treatment plant that was also required under the thermal treatment contract.

Johnston Island Demolition

For this contract, Parsons constructed a 10-acre RCRA Construction Rubble Debris Area (CRDA) landfill. This project also included demolishing and downsizing more than 250 buildings (2 million square feet) existing on Johnston Island. Parsons also sorted, transported, placed, and backfilled over all demolition debris on the island and staged recyclable materials for off-island transport.

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Chemical & Engineering News

Latest News

July 30, 2007

Veterans' Health

Agent Orange And High Blood Pressure

Report suggests connection between herbicide exposure and hypertension

Glenn Hess

Exposure to dioxin-laced agent orange and other defoliants during the Vietnam War may be raising the blood pressure of some veterans, according to a report released on July 27 by the National Academies Institute of Medicine (IOM).

"In two new studies, Vietnam veterans with the highest exposure to herbicides exhibited distinct increases in the prevalence of hypertension," says the committee that wrote the report. The analysis is the seventh update since the early 1990s in a congressionally mandated series by IOM that has been examining evidence about the health effects of these herbicides.

The report says the results of the new studies are consistent with some previous findings. It notes, however, that other research, including a study of workers in a herbicide manufacturing plant, did not find evidence of an association between herbicide or dioxin exposure and increased incidence of high blood pressure.

Because of the inconsistent results, the IOM panel says, the cumulative body of evidence suggests but does not conclusively demonstrate that there is an association between high blood pressure and herbicide exposure.

Several illnesses, including prostate cancer and type 2 diabetes, have been linked to agent orange exposure and are covered by veterans' disability compensation benefits. The Department of Veterans Affairs must now determine whether or not high blood pressure should be added to the list of diseases associated with herbicide exposure.

The U.S. military sprayed approximately 20 million gal of agent orange and other herbicides over parts of South Vietnam and Cambodia between 1962 and 1971 to clear dense jungle and remove cover that could conceal enemy forces.

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Exposure To Dioxins Influences Male Reproductive System, Study Of Vietnam Veterans Concludes

ScienceDaily (Nov. 16, 2006) — A dioxin toxin contained in the herbicide Agent Orange affects male reproductive health by limiting the growth of the prostate gland and lowering testosterone levels, researchers at UT Southwestern Medical Center have found in a cohort study of more than 2,000 Air Force veterans who served during the Vietnam War.

The study, published in the November issue of the journal Environmental Health Perspectives, indicates that exposure to TCDD, the most toxic dioxin contained in Agent Orange, may disturb the male endocrine and reproductive systems in several ways.

"Until now, we did not have very good evidence whether or not dioxins affect the human reproductive system," said Dr. Amit Gupta, a urologist at UT Southwestern and the study's lead author. "Now we know that there is a link between dioxins and the human prostate leading us to speculate that dioxins might be decreasing the growth of the prostate in humans like they do in animals."

The researchers found that veterans exposed to dioxin had lower incidence rates of benign prostate hyperplasia (BPH), better known as enlarged-prostate disease. BPH is a disease in humans that is caused by an enlargement of the prostate. Patients must strain to pass urine and they also must urinate frequently. BPH can lead to complications such as an inability to urinate and urinary tract infection. Surgery is sometimes needed.

Dr. Claus Roehrborn, professor and chairman of urology at UT Southwestern and a study author, said, "We know that dioxin causes many endocrine disturbances in the human body. The study indirectly proves that BPH is an endocrine disorder."

Regarding the decreased risk for BPH found in the veterans groups, Dr. Gupta cautioned that the finding should not be interpreted as a positive result.

"It may be construed that a decrease in the risk of BPH is not a harmful effect, but the larger picture is that dioxins are affecting the normal growth and development of the reproductive system. Moreover, several effective treatments are available for BPH and thus reduction of BPH by a toxic compound is not a desirable effect."

The study was based on data from the Air Force Health Study (AFHS). The AFHS is an epidemiologic study of more than 2,000 Air Force veterans who were responsible for spraying herbicides including Agent Orange during the Vietnam War. This group is called the Ranch Hand group because the spray program was called Operation Ranch Hand. Agent Orange was contaminated by a dioxin called 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD).

This study also involved a comparison group comprising veterans who served in Southeast Asia during the same time period, 1962-1971, but were not involved in the spraying program and thus were exposed to dioxins at levels equivalent to the general population.

The veterans were interviewed and underwent physical examinations and lab tests during six examination cycles. The first cycle was conducted in 1982, so the veterans were followed for more than 20 years.

"We found that the risk of developing BPH decreased with increasing exposure to dioxins in the comparison group," said Dr. Arnold Schecter, professor of environmental sciences at the UT School of Public Health Regional Campus at Dallas and a study author. "The risk of developing BPH was 24 percent lower in the group with the highest dioxin levels compared to the group with the lowest levels. In the Ranch Hand group, the risk of BPH tended to decrease with increased exposure to dioxins, but at extremely high exposure levels there was a tendency for the risk to increase."

In addition, the study shows that higher dioxin exposure is associated with decreased testosterone levels, Dr. Gupta said.

"It is known that lower testosterone levels are associated with decreased sexual function, decreased muscle mass and strength, infertility, increased fatigue, depression and reduced bone density," Dr. Gupta said. "However, we could not conclude from this study that dioxin exposure did lead to any of these adverse affects in the veterans in the study."

The study points out the necessity to conduct additional environmental studies of the impact of dioxins and other toxins on the male reproductive system. Previous research was largely based on animal models, Dr. Gupta said, noting that the urgency of further research is underlined by a rise in disorders of the male reproductive tract over the past several decades.

These include a decrease in sperm production by almost 50 percent, a three- to four-fold increase in testicular cancer, an increase in the incidence of cryptorchidism (undescended testes, a condition where the testes are not in their normal location in the scrotum) and hypospadias (abnormality of the urethra).

The reason for this increase is not known, but it is thought that these disorders might be caused by environmental chemicals that are estrogenic and have endocrine-disrupting effects, Dr. Gupta said.

Dioxins are among the most toxic substances known and are thought to be partially responsible for this increase in male reproductive tract disorders. They are formed as byproducts of processes such as incineration, smelting, paper and pulp manufacturing and pesticide and herbicide production.

Humans are exposed to these chemicals primarily through consumption of animal fat and dairy products. Babies are exposed to the highest levels of dioxins through breast milk. Dioxins are eliminated extremely slowly from the body and they tend to stay in the body for several years to several decades after exposure.

Other researchers contributing to the study came from the UT Health Science Center at San Antonio and the Air Force Research Laboratory, Brooks City-Base, Texas.

Adapted from materials provided by UT Southwestern Medical Center.

UT Southwestern Medical Center (2006, November 16). Exposure To Dioxins Influences Male Reproductive System, Study Of Vietnam Veterans Concludes. *ScienceDaily*. Retrieved December 31, 2007, from http://www.sciencedaily.com/releases/2006/11/061116081851.htm

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Agent Orange Causes Genetic Disturbance In New Zealand Vietnam War Veterans, Study Shows

ScienceDaily (Apr. 21, 2007) — A study published in the journal "Cytogenetic and Genome Research" shows that exposure to Agent Orange, and other defoliants, has led to genetic disturbance in New Zealand Vietnam War veterans which continues to persist decades after their service.

From July 1965 until November 1971, New Zealand Defence Force Personnel fought in the Vietnam War. During this time more than 76,500,000 litres of phenoxylic herbicides were sprayed over parts of Southern Vietnam and Laos to remove forest cover, destroy crops and clear vegetation from around military installations. The most common of these defoliant sprays is known as 'Agent Orange', and has been shown to lead to adverse health effects and cause genetic damage in humans. The current study aimed to ascertain whether or not New Zealand Vietnam War veterans show evidence of genetic disturbance arising as a consequence of their now confirmed exposure to these defoliants.

A sample group of 24 New Zealand Vietnam War veterans and 23 control volunteers were compared using an SCE (sister chromatid exchange) analysis. The results from the SCE study show a highly significant difference ($P < 0.001$) between the mean of the experimental group (11.05) and the mean of a matched control group (8.18). The experimental group also has an exceptionally high proportion of cells with high SCE frequencies above the 95th percentile compared to the controls (11.0% and 0.07%, respectively).

The study therefore concludes that the New Zealand Vietnam War veterans studied here were exposed to a harmful clastogenic substance(s) which continues to exert an observable genetic effect today, and suggest that this is attributable to their service in Vietnam.

Adapted from materials provided by Karger Medical And Scientific Publishers, via AlphaGalileo.

Agent Orange Terminology compiled by Gary D. Moore

The following collection of terms are a combination of medical and scientific words used when reading about **Agent Orange**, herbicide, dioxin, and/or the diseases related to the effects of **herbicide** exposure. I have tried to present these terms at a level that a **normal person** can understand. Sometimes it is an impossible task. I have referenced texts that may help clarify a term. I encourage anyone who is interested in pursuing research, or trying to understand the ill effects of **dioxin** to purchase these references. The "references" have been very helpful in my research efforts. It is my sincere hope that this list of TERMS will clarify, educate, and, hopefully, assist your understanding about dioxin.

Gary D. Moore, SSgt USAF 1968-1972
gary@gmasw.com

Alphabetical Index
(Click on a Letter)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

Adipose of or relating to (animal/human) fat tissue.

ADP or Adenosine diphosphate An intermediary molecule that is converted to ATP when bonded to a third phosphate group. [Adenosine is a combination of adenine and ribose - part of RNA & DNA structures.]

Agent Orange A herbicide containing trace amounts of the toxic contaminant dioxin that was used in the Vietnam War to defoliate areas of jungle growth. The name was derived from the orange identifying strip on drums in which it was stored. Agent Orange was a 1:1 mixture of the n-butyl esters of 2,4-dichlorophenoxyacetic acid (**2,4-D**) and 2,4,5-trichlorophenoxyacetic acid (**2,4,5-T**). A byproduct contaminant of the manufacturing process for 2,4,5-T is 2,3,7,8-tetrachlorodibenzo-para-dioxin (**TCDD**), commonly referred to as **dioxin**. Demand for military Agent Orange resulted in higher levels of dioxin contamination than in the **2,4,5-T** produced for civilian applications.

Description	TCDD (Dioxin)	Foliage Use
Agent Orange	1.77 to 40 ppm	Broad Leaf
Agent Blue (Purple)	32.8 to 45 ppm	Narrow Leaf
Agent Red (Pink)	65.6 ppm	Anything

Agent White (Green)	65.6 ppm	Broad Leaf
Silvex	1 to 70 ppm	Fungicide
2,4,5-T (Current)	0.1 ppm or less	Broad Leaf

Allergy A sensitivity to certain substances including pollens, foods, plants, animals or microorganisms. Indications of allergy include, but not limited to sneezing, itching, skin rashes, and queasiness.

Amino Acid An (organic) acid containing the amino group (NH2). Any of the alpha-amino acids that are the chief components of proteins (manufactured by living cells). Amino acids are an essential part of the diet. If any of the essential amino acids are absent, a deficiency results (especially during critical development times, i.e., pregnancy and childhood). Amino acids directly relate to DNA and RNA (the elemental building blocks of life).

Antibody A protein substance produced in the blood or tissues in response to a specific antigen, such as a bacterium or a toxin. Antibodies destroy or weaken bacteria and neutralize organic poisons. (This is the basis of immunity. **AIDS** is characterized by inability to produce required antibodies.)

Androgenic Having the quality of a steroid hormone, such as testosterone or androsterone. These control the development and maintenance of masculine characteristics.

Antigen (also antigene) Is a substance that upon introduction into the body stimulates the production of an antibody. These include toxins, bacteria, foreign blood cells, and the cells of transplanted organs.

Aromatic Compounds Chemical compounds containing one or more six-carbon rings characteristic of the benzene series and related organic groups. (Amazing... but camphor, a healing and useful drug, is in this group.)

Atoxic Something that is not poisonous or toxic to living organisms.

Atrophy The emaciation. or wasting away of tissues, organs, or the entire body.

ADD or Attention Deficit Disorder. A (childhood) disorder characterized by impulsiveness, hyperactivity, and short attention span. ADD is believed to lead to learning disabilities and various behavioral problems when the children mature.

ATP Adenosine triphosphate (**C10H16N5O13P3**). This is a storehouse of chemical energy in a cell when one of its two high-energy phosphate bonds is broken in hydrolysis. ATP releases energy and becomes ADP.

Autoimmune Relating to an immune response by the body against one of its own tissues or types of cells often thought to be triggered by an external chemical exposure, such as, lead or mercury.

Menu

B

B Cell is a type of lymphocyte that plays a major role in the body's humoral immune response. When stimulated by a particular foreign antigen, B Cell lymphocytes differentiate into plasma cells that synthesize the antibodies (that circulate in the blood and react with the specific antigens). Also: **B-lymphocyte**

Basal Cell Carcinoma (Cancer) is a malignant tumor of the epithelium (skin area) that begins as a small bump and enlarges to the side. It develops a central crater that often crusts and bleeds. The tumor rarely spreads to other organs (**metastasis**), but surrounding tissue is destroyed. In 90% of cases, the tumor grows between the hairline and the upper lip. The main cause of the cancer is excessive exposure to the sun, x-rays, or chemcial compounds (such as **dioxin**). Treatment is surgical removal or x-ray therapy. Also called basal cell epithelioma, basaloma, carcinoma basocellulare, hair matrix carcinoma.

Basophil A cell, especially a white blood cell, having granules.

Benzene Hydrocarbons are found typically in petroleum. Coal tar is one source of hydrocarbons; but most hydrocarbons from coal tar have the carbon arranged in rings rather than in chains. Rings usually have six carbon atoms. The simplest of these hydrocarbons is benzene (C_6H_6). **Chlorobenzene** (a benzene derivative) is used to make insecticides. Compounds with ring structure (verses chains) are called **aromatic compounds**.

Beta-catotene is a vitamin made from the kelp plant (a type of seaweed). Beta-carotene can be converted by the body to vitamin A. Beta-carotene is an anti-oxidant. Do not take more than 50,000 IUs a day, and pregnant women should avoid taking beta-carotene altogether.

Birth Defect is a structural or functional abnormality that develops before birth and is present at the time of birth, especially as a result of faulty development, infection, heredity, or exposure to environmental (**teratogenic**) agents. Also called **Congenital Anomaly**. An excellent site for birth defect information is Association Birth Defects Children

Menu

C

Cancer is any of varity of malignant growths characterized by the proliferation of foreign (growth) cells that corrupt surrounding tissue, and contaminate (new) body tissues. Cancer is a general term for a **tumor**, or about cells (tissue) that have an uncontrolled (or abnormal) growth pattern. Cancerous cells often invade and destroy normal tissue cells. A cancer tends to spread to other parts of the body by releasing cells into the lymphatic system or bloodstream. Thus, the abnormal (cancer) cells are spread far from the point of origin in the body that first produced the (rogue) cells. The first site of cancer is sometimes called a **primary cancer**. The tumor that grows as a result of the original cancer is called a **secondary cancer**. A secondary cancer often is noticed before the primary cancer is found. There are more than 150 different kinds of cancer and as many different causes, including viruses, too much exposure to sunlight or x-rays, cigarette smoking, and chemicals in the environment. The most common sites for the growth of cancerous tumors are the lung, breast, colon, uterus, mouth, and bone marrow. Many cancerous tumors or lesions are curable if found in the early stage. Early signs for cancer may be a change in bowel or bladder habits, a nonhealing sore, unusual bleeding or discharge, a thickening or lump in the breast or elsewhere, indigestion or difficulty in swallowing, an obvious change in a wart or mole, or a nagging cough or continuing hoarseness. There are numerous and sundry treatments, but include: surgery, radiation, and (drug) chemotherapy as well as non-convential herb and vitamin ingestion.

Carcinogen is a cancer-causing substance or agent. Carcinogens can be inorganic, such as asbestos and arsenic, or organic, such as certain molds and viruses. Others include various types of radiation, such as ultraviolet and X-rays. Carcinogens can be inhaled (radon and tobacco smoke), ingested (nitrites), or absorbed through the skin (DDT and other pesticides). According to the Concise Columbia Electronic Encyclopedia **30% of Americans will die** of cancer caused in part by **environmental carcinogens** before they reach the age of 74.

CFC (Chlorofluorocarbon). Any of various halocarbon compounds consisting of carbon, hydrogen, chlorine, and fluorine were once used extensively as (aerosol) propellants and refrigerants. Chlorofluorocarbons are believed to cause the depletion of the (atmospheric) ozone layer.

CFIDS or Chronic Fatigue Immune Dysfunction Syndrome. Induce these symptoms: viral reactivation, immunological abnormalities, extreme fatigue, headaches, neurological and cognitive dysfunction, chronic sore throats, and lymph node enlargement, muscle and joint pain, neuritis, depression and mood swings and chronic infections.

Cholestyramine is a cholesterol-reducing drug. It was recently used to detoxify persons exposed to **ketone**.

Chloracne is a skin condition marked by blackheads and pimples in people who are in contact with chlorinated chemical compounds, as cutting oils, paints, varnishes, and dioxin. The condition usually affects the face, arms, neck, and any other exposed areas.

Chlorine is a highly irritating, greenish-yellow gaseous **halogen**, capable of combining with nearly all other elements. Its element symbol is **Cl**, atomic number 17; atomic weight 35.45; freezing point –100.98·C; boiling point –34.6·C; specific gravity 1.56 (–33.6·C); valence 1, 3, 5, 7. Chlorine does not occur freely in its element form in nature, but its compounds are common minerals. It is the 20th most abundant element on earth. Chlorine is produced (principally) by electrolysis of sodium chloride (salt water). Chlorine is used for bleaching paper pulp and other organic materials, destroying germ life in water, and preparing bromine, tetraethyl lead, and other important products.

Chlorophenoxy is a class of herbicides in which 2,4-D, 2,4,5-T, MCPA, et al, belong.

Cognitive Dysfunction is a psychological condition of conflict or anxiety resulting from inconsistency between one's beliefs and one's actions, such as opposing the slaughter of animals and eating meat.

Complementarity is a matching of components for a desired result; for example, in the paired series: 2_3_1_4_0 2_1_3_0_4 the numerics in the first group complement those in the second group to yield the arbitrary number 4 in each pair. Complementarity underlies membrane construction, protein synthesis, and cell reproduction.

Compound is anything that consists of two or more substances, ingredients, elements, or parts.

Congenital Anomaly. See Birth Defect.

Cytoplasm The protoplasm outside the nucleus of a cell.

Menu

D

Defoliant is a chemical that is sprayed or dusted on plants that cause the leaves to fall off (See: **Agent Orange**).

Dioxin (TCDD). Any of several carcinogenic or teratogenic heterocyclic hydrocarbons that occur as impurities in petroleum-derived herbicides (considered by some to be the most toxic chemical known to man). Dioxin is an ingredient in a certain herbicide used widely throughout the world to help control plant growth. Because of its high level of toxicity, it is no longer made in the United States. Exposure to dioxin is linked to **chloracne** and **porphyria cutanea tarda**. Dioxin is the toxic contaminant of Agent Orange, sprayed by the U.S. military aircraft on areas of southeast Asia from 1965 to 1970 to kill concealing trees and shrubs (approximately 4200 square miles). No safe exposure levels have been found. It has been strongly linked to many cancers and is very harmful to all living things. Chemically known as: **2,3,7,8-tetrachlorodibenzopara-dioxin or 2,3,7,8-T**.

Diuretic is a liquid, substance, or drug that can increase the discharge of urine.

DNA or Deoxyribonucleic acid is what holds the genetic information needed for heredity.

Menu

E

Electromechanochemical Energy is the interconversion of electrical, mechanical, and chemical energy by the cell's energy-gathering systems to unleash, gather, and store the power locked in **ATP**.

Environmental Agents include drugs, chemicals, pesticides, dioxin, mercury, lead, radiation, etc., or combination of these.

Environmental Hormone are environmental agents that alter growth patterns in living organisms (plants, animals, humans) unnaturally.

Enzyme is protein that catalyzes, or speeds up, biochemical reactions without itself undergoing a lasting change.

Esters are a class of organic compounds corresponding to the inorganic salts and formed from an organic acid and an alcohol with the elimination of water. Esters are organic compounds in which two hydrocarbon groups are linked by an oxygen atom.

Estrogenic relates to any of several steroid hormones produced chiefly by the ovaries and responsible for promoting estrus and the development and maintenance of female secondary sex characteristics.

Menu

F

FAS or Fetal Alcohol Syndrome is a pattern of congenital malformation that has been identified in the children of chronically alcoholic women. It may include growth and mental deficiency, microcephaly, short palpebral fissures (relating to the eyelid), and other anomalies of the skeleton and heart.

Fluorocarbon is an inert liquid or gaseous halocarbon compound in which fluorine replaces some or all hydrogen molecules, used as aerosol propellants, refrigerants, solvents, and lubricants and in making plastics and resins. See: CFC.

Menu

G

Granule. *Relating to biology* is a cellular or cytoplasmic particle.

Menu

H

Half-Life is the time required for **half the quantity of a drug or other substance** within in a living organism to be metabolized or eliminated by normal biological processes. Also called **biological half-life**. Note: Dioxins' half-life is several years (8.6 years per the Ranch Hand Study.)

Halocarbon is a compound, such as a fluorocarbon, that consists of carbon and one or more halogens.

Halogen is any of a group of five chemically related nonmetallic elements including **fluorine, chlorine, bromine, iodine, and astatine**. The name halogen, (salt former) refers to the property of each of the halogens to form with sodium a salt similar to common salt (sodium chloride). Each member of the group has a valence of 1 and combines with metals to form halides, as well as with metals and nonmetals to form complex ions.

Haloginated is a substance that has been treated or combine with a halogen.

Herb is an aromatic plant used especially in medicine or as seasoning. Herbs have been cultivated for centuries for their natural healing properties.

Herbicide is a chemical substance used to destroy, or inhibit the growth of plants, especially weeds. Many herbicides kill by over stimulating growth (hormones). Herbicides can be selective (killing specific plants), or non-selective (killing everything in the area in which they are used).

Heterocyclic means containing more than one kind of atom joined in a ring.

Histamine is a white crystalline compound, $C_5H_9N_3$, found in plant and animal tissue, used as a agent to dilate blood vessels.

Hodgkin's Disease is a malignant, progressive, sometimes fatal disease of unknown etiology, marked by enlargement of the lymph nodes, spleen, and liver. Symptoms include loss of appetite, weight loss, generalized itching, low-grade fever, night sweats, a decrease of red blood cells, and increase of white blood cells. Approximately 7,100 Americans are diagnosed with the disease annually, and causes approximately 1,700 deaths a year, affects twice as many males as females, and usually develops between 15 and 35 years of age. Radiation of lymph nodes, using a covering mantle to protect other organs, is the usual treatment for early stages of the disease. Combination chemotherapy is the treatment for advanced disease. In more than one-half of the patients treated, the symptoms go away for long periods of time, and 60% to 90% of those with limited spreading of the disease may be cured. It is widely held that Hodgkin's disease may start as a swelling or infection and then develop into a tumor. According to another theory it may be a disorder of the immune system. Clusters of cases have been reported, but there is no definite evidence of an infectious agent, and the cause of the disease remains a mystery. Named for Thomas Hodgkin (1798-1866), British physician.

Hormone is a substance, usually a peptide (natural or synthetic amino acid compound) or steroid (natural or synthetic compound), produced by one tissue and conveyed by the bloodstream to another that effects physiological activity, such as growth or metabolism. Note: Dioxins alter the growth pattern of plants; energizing rapid growth so as to burn-out the plant. Therefore, dioxin is considered an environmental hormone.

Hydrogen Chloride (HCl) is a colorless pungent poisonous gas that fumes in moist air and produces hydrochloric acid when dissolved in water. **HCl** is used in the manufacture of plastics.

Hydrolysis is a breakdown of a chemical compound by reaction with water as in the separation of a dissolved salt, or the (catalytic) conversion of starch to glucose.

Menu

I

Immunoassay is a laboratory or clinical technique that makes use of the specific binding between an antigen and its homologous antibody in order to identify and quantify a substance in a sample.

Immunosuppression is the suppression of the immune response, as by drugs or radiation, in order to prevent the rejection of grafts or transplants or control autoimmune diseases. Also called **immunodepression**.

Isomer is a compound having the same percentage composition and molecular weight as another compound but differing in chemical or physical properties.

Ipecac (also ipecacuanha) 1. A tropical American shrub having roots and root stocks that produce a bitter-tasting crystalline alkaloid (emetine). 2. A medicinal preparation that is used to induce vomiting, particularly in cases of poisoning and drug overdose. Note: Ipecac syrup is used to detoxify persons exposed to dioxins, etc.

Menu

K

Ketone is a class of organic compounds having a carbonyl group linked to a carbon atom in each of two hydrocarbon radicals. The simplest ketone, **acetone (CH3-CO-CH3)**, matches the general ketone formula, (three hydrogen atoms attached to each of the end carbon atoms). Other ketones are camphor, many steroids, some fragrances, and some sugars. Ketones are relatively reactive organic compounds and are invaluable in synthesizing other compounds. They are also important intermediates in cell metabolism.

Menu

L

Leukemia is any of various acute or chronic neoplastic diseases of the bone marrow in which unrestrained proliferation of white blood cells (leukocytes) occurs, usually accompanied by anemia, impaired blood clotting, and enlargement of the lymph nodes, liver, and spleen. Males are affected twice as frequently as females. The cause of leukemia is not clear, but it may result from exposure to radiation, benzene, or other chemicals that are toxic to bone marrow. Diagnoses of acute and chronic forms are made by blood tests and bone marrow studies. The most effective treatment includes intensive chemotherapy, using antibiotics to prevent infections, and blood transfusions.

Lipids are a diverse group of organic compounds, including fats, oils, waxes, sterols, and triglycerides, that are insoluble in water but soluble in common organic solvents (alcohol, ether, etc.). Lipids are oily to the touch. The most important lipids are the phospholipids, which are major components of the cell membrane. Lipids together with carbohydrates and proteins are the principal structural material of living cells. Other important lipids are the waxes that form protective coatings on the leaves of plants and the skins of animals, and the steroids that include vitamin D, and several key hormones.

Lupus is any of several diseases, especially systemic lupus erythematosus, that principally affect the skin and joints but often also involve other systems of the body.

Lymphocyte is a white blood cell formed in lymphoid tissue.

Lymphoma is any of various usually malignant tumors that arise in the lymph nodes or in other lymphoid tissue.

Lymphosarcoma See: Non-Hodgkin's-Lymphoma.

Menu

M

Metastasis is the spread of pathogenic microorganisms or cancerous cells from an original site to one or more sites elsewhere in the body, usually by way of the blood vessels, or lymphatics. It also means a secondary cancerous growth formed by transmission of cancerous cells from a primary growth located elsewhere in the body.

Microcephaly is the abnormal smallness of the head.

Morbidity is the rate of incidence of a disease often in reference to epidemilogy studies.

Mortality in reference to health issues, a death rate.

Mitochondria is any of various round or long cellular organelle in the cytoplasm of nearly all eukaryotic cells, containing genetic material and many enzymes important for cell metabolism, including those responsible for the conversion of food to usable energy (through cellular respiration).

Myeloma is a bone-destroying tumor. This cancer can (and often does) develop at the same time in many location of the body (thus, multiple). Myeloma causes large areas of destruction of the bone. The tumor occurs most often in the ribs, vertebrae, pelvic bones, and flat bones of the skull. Intense pain and fractures are common. Various types of myeloma include: endothelial myeloma, extramedullary myeloma, giant cell myeloma, multiple myeloma, osteogenic myeloma.

Menu

N

Neoplasia is the formation of new tissue. It also relates to the formation of a neoplasm(s).

Neurotoxin is a toxin that damages or destroys nerve tissue.

Non-Hodgkin's-Lymphoma or NHL is a cancer (disease) of the body cells that create abnormal formations (swells). Any kind of cancer of the lymph tissues other than Hodgkin's disease. Also called **lymphosarcoma**.

Menu

O

Organelle is a differentiated structure within a cell, such as a mitochondrion, vacuole, or chloroplast, that performs a specific function.

Oxidation is loss of electrons by an atom. Burning is rapid oxidation.

Menu

P

PCB is any of a family of industrial compounds produced by chlorination of **biphenyl**. Noted primarily as an environmental pollutant that accumulates in animal tissue with resultant pathogenic and teratogenic effects. Known as **polychlorinated biphenyl**.

Peripheral Neuropathy is any disorder of the motor and sense nerves that are outside of the brain and spinal cord (therefore, a peripheral nervous system disorder). One example is a numbness or tingling feeling in the fingers (paresthesia).

Phenoxy herbicide is any of a class of aromatic organic compounds having at least one hydroxyl group attached directly to the benzene ring.

Phospholipid is a (bimodal) molecule composed of two contradictory elements like a phosphate group that attractives water and a lipid which repels water.

Pi ia the symbol for an **inorganic phosphate**.

Prostate cancer is the 3rd leading cause of cancer deaths in the US (males over the age of 50). It is a slow spreading cancer of the prostate gland. More than 120,000 new cases are reported in the United States each year. A direct cause of Prostate Cancer is not known, but it is believed to be hormone-related. Be cautioned that a male may not have direct symptoms, but the cancer may be detected due to bladder blockage, infection, or the presence of blood in the urine. The cancer can spread, and cause bone pain in the pelvis, ribs, or spine. It is commonly found by rectal examination followed by tissue removal and examination (biopsy). Treatment is by surgery, radiation therapy, and hormones. Treatment depends on the age of the patient, the extent of the disease, and other factors.

Protein is a large molecule comprised of amino acids in a distinct arrangement.

PTSD or Post Traumatic Stress Disorder (Dysfunction) is a psychological condition that occurs after a stressful situation (e.g., war, accident, rape, child abuse, etc.). PTSD is characterized by anxiety, depression, guilt, sorrow (or grief), a sense of shame, death anxiety, panic, low self-esteem, rage, and/or any combination of these. Treatment varies with the severity, and willingness of the person to seek help.

Menu

R

Radical *In chemistry*, is a small ionized group of atoms that are bound together and that tend to function as a single unit in chemical reactions. Some examples of radicals are the hydroxide (OH), sulfate (SO42), and ammonium (NH4+). The (so-called) free radicals are neutral groups of atoms with an unpaired electron. This makes most of them reactive and unstable. Free radicals are common as transient intermediaries in chemical reactions. Processes involving free radicals are used in the production of rubber and plastics. They are also common in chain reactions such as fire. Free radicals occur in body chemistry, i.e., when white blood cells kill invading organisms. Free radicals are implicated in various maladies, such as arthritis, heart disease, and Alzheimer's disease. When natural enzyme controls fail, the free radicals attack lipids, proteins, and nucleic acids. This, in part, explains the harm done by carcinogens and blood fats.

Reduction is the gain of electrons by an atom.

Ribosome is a minute, round particle composed of RNA and protein found in the cytoplasm of living cells and active in the synthesis of proteins.

RNA or Ribonucleic acid is a universal polymeric constituent of all living cells, consisting of a single-stranded chain of alternating phosphate and ribose units with the bases adenine, guanine, cytosine, and uracil bonded to the ribose, the structure and base sequence of which are determinants of protein synthesis. Ribonucleic acid is the complement to DNA; it transcribes DNA's genetic instructions for the manufacture of proteins.

Menu

S

Sarcoma is a malignant tumor arising from connective tissues. Sarcoma is often a cancerous growth of the soft tissues usually appearing at first as a painless swelling. About 40% of sarcomas occur in the legs and feet, 20% in the hands and arms, 20% in the trunk, and the rest in the head or neck. The growth tends to spread very quickly. It is usually not caused by an injury, but it can grow in burn scars. Sarcoma must be cut out, and then the body is usually given x-ray and chemical treatment. [Plural: sarcomas, sarcomata]

Soft Tissue Sarcomas are tumors in muscles, fat, fibrous tissue, and vessels serving these tissues as well as the peripheral nervous system.

Spina Bifida is a congenital defect in which the spinal column is imperfectly closed so that part of the spinal cord (meninges) protrudes, often resulting in hydrocephalus and other neurological disorders. Also called **schistorrhachis**.

Menu

T

T cell is a principal type of white blood cell that completes maturation in the thymus and that has various roles in the immune system, including the identification of specific foreign antigens in the body and the activation and deactivation of other immune cells. Also: **T lymphocyte**

TCDD or Tetrachlorodibenzo-p-dioxin (also 2,3,7,8-Tetrachlorodibenzo-p-dioxin) is a family of dioxins that contain four (4) chlorine atoms each.

Teratogen ia an agent, such as a virus, a drug, or radiation, that causes malformation of an embryo or a fetus (i.e., birth defects).

Thalidomide is a sedative and hypnotic drug, $C_{13}H_{10}N_2O_4$, withdrawn from sale in the U.S. after it was found to cause severe birth defects, especially of the limbs, when taken during pregnancy. It is available in many third world countries without warning and education.

Toxin a poisonous substance, especially for a protein. Toxins are produced by living cells or organisms, and capable of causing disease when introduced into the body tissues. Toxins are also capable of inducing neutralizing antibodies or antitoxins.

Menu

V

Virulent is something that is extremely poisonous or harmful, e.g., a disease or microorganism.

Menu

X

Xenobiotic foreign to the body or to living organisms. Normally referring to a synthetic chemical, e.g., a pesticide.

Menu

References

Include, but not limited to:

- Funk & Wagnells New Encyclopedia
- Merriam-Webster's Collegiate Dictionary
- The American Heritage Dictionary

Additions, comments, suggestions, and corrections can be addressed to:

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or

e-mail WebMaster: Gary

Update: September 23, 2006

- POW/MIA Flag Origin
- Gary's Main Web Page
- Links List
- Site Map
- 10th Annual Michigan Remembers Run Information (2008)
- Gary's PDF Files (Downloads)
- Agent Orange Information
- Agent Orange Talking Paper #1
- Contaminated U.S. Military Bases
- Veteran Information & Calendar
- VVA Chapter Locator (National)
- VVA Chapter Site List
- VVA National
- Veteran's Administration Web Site
- VA 'Hepatitus-C' Web Site
- VA Claim, List of Documents Needed to File a

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November 7, 1979

Major Alvin Young
USAFSAM/EK
Brooks AFB, TX 78235

Dear Al,

Listed in the enclosed tables are the final pesticide analytical results for the soil samples from the Gulfport, Mississippi and Johnston Island Herbicide Orange storage facilities. These results along with the water sample analysis results discussed below represent completion of the chemical analysis for this contract. A formal final report will be forthcoming to summarize some of our observations of data trends and to augment the first year final report with any analytical procedure changes from last year.

The six enclosed tables contain results from three different types of soil samples for each of the two storage facilities. In Tables 1 and 2 are summarized the results from all the samples taken between July 1977 and August 1979 from Herbicide Orange spill sites at the Gulfport (GP) and Johnston Island (JI) facilities respectively. The sample date code is defined as follows: date code 9 for samples collected 28 July 1977 and 25 August 1977 from GP and JI sites respectively; date code 0 for samples collected in January 1978 from both sites; date code 1 for samples collected 6 November 1978 and 18 October 1978 from GP and JI sites respectively; and a date code of 2 for samples collected 14 June 1979 from a GP site and 8 August from JI sites. Given in Tables 3 and 4 are the results for soil penetration studies done at one GP and two JI sites respectively. The presence of pesticide components is here shown to extend more than 20 centimeters below that soil surface. The analytical results for non-spill sites for GP and JI are listed in Tables 5 and 6 respectively. The samples in these last two tables are primarily water drainage or ocean sediment samples but also include samples from two non-storage site islands in the Johnston Island area and two laboratory blanks. The two laboratory blanks reported were run on Fisher Scientific Co. Washed and Ignited Sea Sand and give some indication of the lower detection limits for the analytical methods. The exact source of these small blank contaminations is uncertain but they appear to possibly come from previous sample carry over. Thus the stated pesticide values for all of the sediment or other low concentration samples represent upper limits of actual contamination.

The twelve water samples from the two storage facilities were analyzed for TCDD only. These included five JI samples labelled JI-1/7879 through JI-5/7879 collected on 7 August 1979. The GP water samples consisted of two labelled simply W-1 and W-2 which were collected on 14 June 1979 and five (out of seven) potable water samples collected on 31 July 1979 which were labelled D331Y9, D431Y9, D131Y9, D231Y9 and D531Y9. Each of these samples were extracted by adding sodium chloride to an aliquot of the water to make a five percent salt solution and then extracting with pesticide grade hexane. The hexane extract was then reduced in volume to 50 microliters and analyzed by GC/MS the same as the soil extracts. The two GP samples from 14 June 1979 labelled W-1 and W-2 were analyzed as 100 milliliter (ml) aliquots and were found to contain <25 parts per trillion (1 ppt = 1×10^{-9} gram/liter) of TCDD. The five JI and the other five GP water samples were each analyzed as 200 ml aliquots and were found to contain <20 ppt of TCDD.

I believe these results fully satisfy the analytical requirements of the FRC on this contract and understand that their receipt will begin procedures for completion of payment to the University of Utah. I am still awaiting contact from Lt. Colonel Falcon concerning disposal of our contaminated wastes and samples. As mentioned earlier, the formal final report on this project will be in preparation during the next month. If you have any suggestions for the final report or any other questions or comments please feel free to contact either myself or Mason Hughes.

Sincerely,

Bill McClennen

William H. McClennen

WHM/mv

Enclosures

cc: B. M. Hughes

TAB . 2

SUMMARY OF ANALYTICAL RESULTS FOR HERBICIDE ORANGE, ITS HYDROLYSIS PRODUCTS AND TCDD

IN THE JOHNSTON ISLAND STORAGE FACILITIES

µg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date[a] Code	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
9	01	ND1[b]	0.4	10.1	10.8	ND1	ND1	ND2	ND2	N/A[c]
0	01	ND1	1.3	0.8	0.1	ND1	ND1	ND2	ND2	N/A
1	01	ND1	0.1	3.0	4.0	0.1	0.3	2.2	6.4	N/A
9	02	5.4	0.3	12.0	18.0	ND1	0.1	ND2	ND2	N/A
0	02	ND1	0.8	2.8	0.7	0.2	1.8	ND2	0.5	N/A
1	02	ND1	0.1	1.0	2.0	ND1	0.1	0.9	2.5	N/A
9	03	ND1	ND1	0.7	7.6	ND1	ND1	ND2	ND2	N/A
0	03	ND1	0.7	3.3	0.6	0.1	0.3	ND2	ND2	N/A
1	03	ND1	0.1	0.2	0.4	ND1	0.03	0.1	0.5	N/A
9	04	ND1	0.3	14.4	29.3	ND1	0.2	ND2	ND2	N/A
0	04	ND1	1.7	5.6	0.1	0.5	1.3	ND2	ND2	N/A
1	04	ND1	ND1	0.2	0.4	0.2	ND1	0.1	0.5	N/A
9	05	ND3	93.0	12600	8750	4230	12500	ND3	ND3	.0330
0	05	ND3	123	11800	10200	1980	13800	≤600	~600	.0340
1	05	ND3	34.2	7930	22000	ND3	1510	ND3	ND3	.0191
2	05	ND3	ND2	971	2590	ND3	ND3	ND3	ND3	.041
9	06	ND3	63.5	4720	638	31200	10300	7900	30600	≤.065
0	06	ND3	255	6050	1720	10400	7630	~15000	32000	≤.006
1	06	ND3	136	17600	10900	ND3	143	1800	11300	.0076
9	07	ND2	32.7	1980	1250	6600	6790	520	424	.0113
0	07	6.8	14.1	1970	1670	25.2	197	910	340	.007
1	07	1.6	7.2	944	628	8.0	29.9	23.2	121	.0082

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Johnston Island Storage Facilities (Continued)
PAGE TWO

µg/g

Sample Date [a] Code	Site No.	IMPURITIES: Dichloro-phenol	IMPURITIES: Trichloro-phenol	HYDROLYSIS PRODUCTS: 2,4-D	HYDROLYSIS PRODUCTS: 2,4,5-T	HERBICIDE ORANGE COMPONENTS: Butyl Ester 2,4-D	HERBICIDE ORANGE COMPONENTS: Butyl Ester 2,4,5-T	HERBICIDE ORANGE COMPONENTS: Octyl Ester 2,4-D	HERBICIDE ORANGE COMPONENTS: Octyl Ester 2,4,5-T	TCDD
9	08	ND2	13.2	1520	525	ND1	211	ND3	1270	.0046
0	08	ND1	2.3	1.7	2.0	ND1	0.5	2.0	7.8	N/A
1	08	ND1	ND1	0.1	0.2	0.1	0.1	0.1	0.4	N/A
9	09	ND3	205	1370	1390	22100	19100	5140	3170	.0417
0	09	ND3	181	7800	5790	21400	21100	9000	5000	.022
1	09	ND3	111	15700	11500	14700	12300	3900	2430	.0286
2	09	ND3	149	15500	15600	2240	4440	3480	2970	.053
9	10	ND3	460	42600	45600	24600	19800	≤1600	1050	.196
0	10	ND3	477	31100	46600	23300	27300	~9000	~4000	.230
1	10	ND3	456	38700	61000	27100	25900	~4000	~3000	.235
2	10	ND3	136	21200	26400	100	83.8	~520	~360	.13
9	11	ND3	34.9	4080	3650	24400	24500	≤560	330	.0534
0	11	ND1	1.9	2.1	3.6	0.9	6.2	7.2	9.4	≤.0025
1	11	0.1	0.6	5.0	38.5	0.8	4.3	6.3	10.1	≤.0038
9	12	ND3	172	1560	1370	32800	33500	ND3	~300	.178
0	12	ND3	110	2300	1200	26200	27300	ND3	ND3	.080
1	12	ND3	46.6	13200	18200	7150	4290	ND3	ND3	.111
2	12	ND3	53.6	6530	8680	817	1900	≤400	100	.081
0	13	ND2	11.2	23.9	23.7	ND2	1.0	ND2	ND2	≤.0003
1	13	ND1	ND1	ND1	0.1	ND1	ND1	ND1	0.2	N/A
0	14	ND1	0.8	4.4	0.6	0.2	1.0	ND2	1.2	N/A
1	14	ND1	ND1	0.1	0.3	0.1	0.2	0.4	0.6	N/A
0	15	ND1	1.5	3.8	ND1	ND1	ND1	ND1	ND1	N/A
1	15	ND1	ND1	0.1	0.3	ND1	ND1	0.1	0.2	N/A

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Johnston Island Storage Facilities (Continued)

µg/g

Sample Date Code[a]	Site No.	IMPURITIES: Dichloro-phenol	IMPURITIES: Trichloro-phenol	HYDROLYSIS PRODUCTS: 2,4-D	HYDROLYSIS PRODUCTS: 2,4,5-T	HERBICIDE ORANGE COMPONENTS: Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
0	16	ND1	1.5	1.2	0.1	ND1	0.1	ND1	ND1	N/A
1	16	ND1	ND1	0.1	0.1	ND1	ND1	0.1	0.2	N/A
0	17	ND2	12.5	5.8	6.8	ND2	ND1	ND2	ND2	N/A
1	17	ND1	0.1	0.1	0.3	ND1	0.1	0.1	0.2	N/A
0	18	ND2	11.1	691	2920	28.8	57.2	13.1	46.0	.001
1	18	ND2	0.4	2.0	4.9	0.7	1.5	ND2	ND2	<.0014
0	19	ND1	1.4	1.3	0.2	0.1	0.2	ND2	ND2	N/A
1	19	ND1	ND1	ND1	0.2	ND1	ND1	0.1	0.1	N/A
0	20	ND1	1.3	4.7	0.1	ND1	ND1	ND1	0.1	N/A
1	20	ND1	ND1	ND1	0.1	ND1	ND1	0.1	0.1	N/A
0	21	ND1	1.4	1.0	0.3	ND1	ND1	ND1	ND1	N/A
1	21	ND1	ND1	ND1	0.1	ND1	0.1	0.1	0.2	N/A
0	22	ND1	0.1	0.6	0.2	ND1	ND1	ND1	ND1	N/A
1	22	ND1	0.2	3.9	8.8	1.9	2.4	1.6	1.5	N/A
0	23	ND2	9.0	47.6	23.4	ND2	3.4	ND2	ND2	≤.0006
1	23	ND1	0.1	0.9	2.4	0.4	3.7	0.4	0.4	N/A
0	24	ND3	206	3440	2130	24500	22000	~9000	8000	.025
1	24	ND3	81.3	9690	12100	ND3	646	~500	~2000	.024
2	24	ND3	125	19500	20600	ND3	341	2900	3100	.064
0	25	ND2	4.2	6.0	4.6	ND2	1.2	ND2	2.7	N/A
1	25	0.1	1.8	20.6	38.1	11.0	36.9	34.3	27.2	N/A

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Johnston Island Storage Facilities (Continued)
PAGE FOUR

μg/g

		IMPURITIES		HYDROLYSIS PRODUCTS		HERBICIDE ORANGE COMPONENTS				
Sample Date Code[a]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
0	26	ND2	3.8	45.3	88.6	2.2	18.6	≤10	≤20	.010
1	26	ND2	0.2	1.0	6.1	0.2	0.4	1.4	1.4	.003
2	26	ND3	8.0	245	256	ND3	ND3	ND3	ND3	.011
0	27	ND2	3.2	3.1	1.5	0.5	0.5	ND2	ND2	≤.0002
1	27	ND1	0.1	0.5	5.0	0.1	1.1	0.8	0.6	N/A
0	28	ND3	31.8	26800	38800	ND3	316	ND3	ND3	.0002
1	28	ND3	14.3	9010	13200	ND3	461	ND3	ND3	<.0009
0	29	0.7	4.0	13.6	62.8	18.1	69.7	6.2	11.7	.0008
1	29	ND2	0.1	0.2	0.6	ND2	ND1	ND2	1.0	N/A
0	30	ND3	45.1	4480	2600	6980	11800	1400	500	.038
1	30	ND3	22.2	3170	4760	2400	2250	ND3	ND3	.036
2	30	ND3	20.0	708	3270	193	563	340	97	.040
0	31	ND2	4.5	71.8	303	2.3	21.3	≤17	19.9	.002
1	31	ND2	0.3	0.9	6.6	0.5	0.4	1.2	0.5	<.0014
0	32	ND3	138	18800	17700	3590	7680	ND3	ND3	.0007
1	32	ND3	18.8	10100	20100	ND2	ND2	ND3	ND3	≤.0023
0	33	ND1	0.6	13.8	0.4	0.3	1.3	1.1	0.4	N/A
1	33	1.4	27.1	197	151	60.7	4.9	1.3	1.4	N/A
0	34	ND3	23.9	2280	2080	81.5	583	ND3	ND3	.029
1	34	ND3	27.7	3240	7770	ND3	133	ND3	ND3	.152
2	34	ND3	32.0	2970	9130	ND3	10.1	ND3	ND3	.15
0	35	ND3	99.0	16500	14700	350	350	-6000	12000	.008
1	35	ND3	82.5	23400	26100	ND3	444	-4000	-28000	≤.0056

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Johnston Island Storage Facilities (Continued)
PAGE FIVE

µg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date Code[c]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
0	36	ND3	150	15300	10500	37100	44800	ND3	ND3	.015
1	36	ND3	61.1	14200	29900	ND3	841	ND3	ND3	.019
2	36	ND3	179	29200	36600	1040	8570	ND3	ND3	.074
0	37	ND3	223	10800	10800	21000	30200	ND3	ND3	.074
1	37	ND3	113	19900	20600	12300	11900	ND3	ND3	.094
2	37	ND3	81.7	10900	11000	402	1170	≤200	≤500	.14
0	38	ND3	169	2780	1230	8630	7350	22000	14000	.006
1	38	ND3	134	12900	7840	ND3	1640	~10000	10000	≤.0018
0	39	ND3	38.8	1740	1370	6380	10200	ND3	ND3	.029
1	39	ND3	30.4	1640	2290	1960	2250	ND3	ND3	.041
2	39	ND3	7.9	492	1530	ND3	24.7	ND3	ND3	.050
0	40	ND3	236	11400	9350	31700	29700	13000	5000	.055
1	40	ND3	120	21900	21900	10100	6330	~1000	~2000	.053
2	40	ND3	116	13000	12900	635	1940	2700	2700	.084
0	41	ND3	280	11900	10600	25100	32600	5000	~2200	.085
1	41	ND3	143	26900	29700	10200	5850	~300	~800	.127
2	41	ND3	183	36300	38700	1990	5840	~1000	900	.12
0	42[d]	ND3	274	2470	5050	16700	17600	~13000	~5000	.025
1	42	ND3	98.7	5460	3930	4430	4390	~1500	~1500	.020
2	42	ND3	108	2650	3330	1060	2600	~2000	~1900	.021
0	43[d]	ND1	0.1	0.5	0.5	ND1	ND1	ND2	ND2	≤.0001
0	44	ND1	0.4	2.4	23.9	0.4	1.6	ND2	ND2	N/A

Summary of Analytical Results for Herbicide Orange, Its Hydrolysis Products and TCDD in the Johnston Island Storage Facilities (Continued)
PAGE SIX

μg/g

		IMPURITIES		*HYDROLYSIS PRODUCTS*		*HERBICIDE ORANGE COMPONENTS*				
Sample Date Code[a]	Site No.	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
0	45	ND1	0.1	0.5	2.5	0.1	0.6	ND2	ND2	N/A
0	46[d]	ND3	203	2830	2170	17800	16100	6000	4000	.024
0	47[d]	5.8	10.6	574	25.9	10.2	ND1	ND2	ND2	≤.0002
0	48[d]	ND1	0.3	1.2	0.4	ND1	ND1	ND2	ND2	≤.0002

[a] Sample Date Code: 9 - 25 August 1977
0 - January 1978
1 - 18 October 1978
2 - 8 August 1979

[b] ND - none detected: ND1 - lower limit of detectability of 0.1 μg/g
ND2 - lower limit of detectability of 1.0 μg/g
ND3 - lower limit of detectability of 100 μg/g

[c] N/A - not analyzed

[d] Soil depth studies done on Johnston Island sites 42 and 46 in January 1978:

0-42 from 0-8 cm depth at site 42
0-43 from 8-16 cm depth at site 4
0-46 from 0-15 cm depth at site 4
0-47 from 15-30 cm depth at site
0-48 from 30-45 cm depth at site

TABLE 4

PESTICIDE ANALYSIS RESULTS OF PENETRATION STUDY CORAL SAMPLES TAKEN FROM JOHNSTON ISLAND SITES NO. 10 AND NO. 37 ON 8 AUGUST 1979.

μg/g

Sample Depth (cm)	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
Site #10									
0-2	ND3[a]	120	29200	30200	65.1	257	590	500	.067
2-4	ND3	243	24900	31400	57.9	38.0	630	680	.14
4-6	ND3	115	15200	24100	36.5	19.4	630	220	.17
6-8	ND3	68.0	15600	20100	239	21.4	≤240	50	.10
8-12	ND3	44.3	7220	9800	119	37.2	64	22	.042
12-16	ND3	43.6	9930	13600	182	131	60	12	.045
16-20	ND3	52.8	10100	12900	240	398	57	47	.055
20-24	ND3	60.1	9410	10500	364	1020	51	84	.042
Site #37									
0-2	ND3	133	17700	22300	681	2530	280	640	.14
2-4	ND3	108	13500	11500	355	1310	290	840	.14
4-6	ND3	75.5	9570	7290	210	826	300	430	.135
6-8	ND3	10.5	2670	2990	360	17.6	64	210	.049
8-12	ND3	7.9	638	646	ND3	ND2	ND3	ND3	.015
12-16	ND3	7.0	130	230	ND3	ND2	ND3	ND3	.006
16-20	ND3	7.2	286	695	ND3	11.0	ND3	ND3	.011
20-24	ND3	7.9	66.2	138	ND3	ND2	ND3	ND3	.005

[a] ND - none detected

ND1 - lower limit of detectability of 0.1 μg/g
ND2 - lower limit of detectability of 1.0 μg/g
ND3 - lower limit of detectability of 100 μg/g

TABLE 6

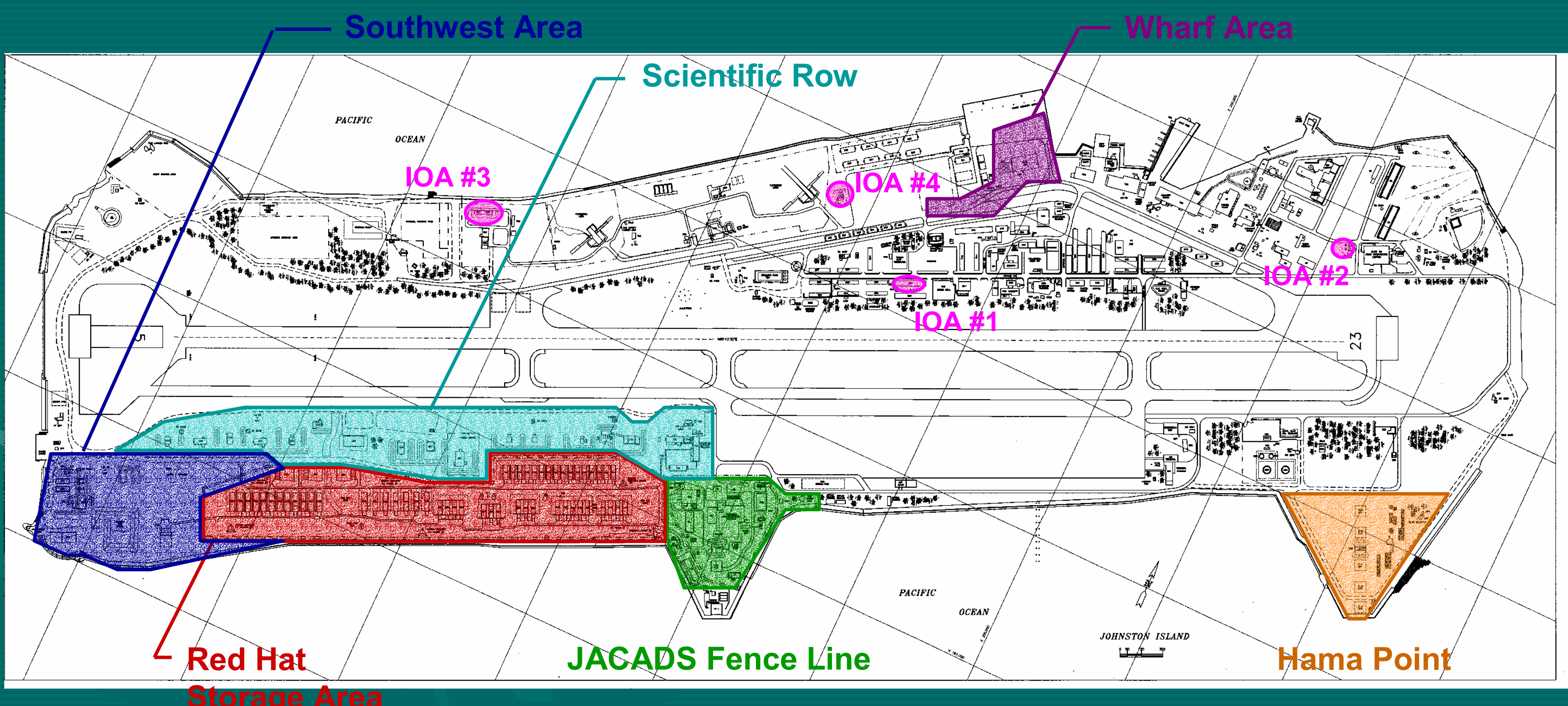
PESTICIDE ANALYSIS RESULTS OF OCEAN FLOOR SEDIMENT SAMPLES AND CONTROL SOIL SAMPLES FROM JOHNSTON ISLAND AND LABORATORY BLANKS. THE SEDIMENT SAMPLES WERE TAKEN ON 7 AUGUST 1979 AND THE CONTROL SAMPLES FROM SAND ISLAND AND NORTH ISLAND WERE TAKEN IN OCTOBER 1978.

µg/g

Sample	Dichloro-phenol	Trichloro-phenol	2,4-D	2,4,5-T	Butyl Ester 2,4-D	Butyl Ester 2,4,5-T	Octyl Ester 2,4-D	Octyl Ester 2,4,5-T	TCDD
JISED-1	0.13	0.03	1.4	2.1	ND1[a]	ND1	<0.02	<0.04	≤.0005
JISED-2	0.07	0.03	0.2	0.2	ND1	0.01	<0.01	<0.1	≤.001
SAND IS.	ND1	0.02	0.11	0.06	ND1	0.01	ND1	ND1	N/A[b]
NORTH IS.	ND1	0.09	ND1	0.09	ND1	0.02	ND1	ND1	N/A
BLANK-1	ND1	ND1	0.2	0.02	ND1	ND1	ND1	ND1	
BLANK-2	ND1	ND1	0.3	0.07	ND1	0.02	ND1	ND1	

[a] ND1 - none detected, lower limit of detectability of 0.1 µg/g.
[b] N/A - not analyzed.

Army Area of Influence on Johnston Atoll



Individual Operational Areas