INDUSTRIAL SERVICES, INC.

DEMONSTRATION

OF

RETRIEVAL METHODS

FOR

WESTINGHOUSE HANFORD CORP.

October 20, 1995

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MPW WASTE RETRIEVAL

DEMONSTRATION OF RETRIEVAL METHODS

OCTOBER 20, 1995

INDEX

DEMONSTRATION REPORT - MPW INDUSTRIAL SERVICES, INC.
FOR WESTINGHOUSE HANFORD CORPORATION

I. BACKGROUND -

Westinghouse Hanford Corporation has been pursuing strategies to break up and retrieve the radioactive waste material in single shell storage tanks at the Hanford Nuclear Reservation, by working with non-radioactive "saltcake" and sludge material that simulate the actual waste.

It has been suggested that the use of higher volumes of water than used in the past (10 gpm nozzles at 10,000 psi) might be successful in breaking down the hard waste simulants. Additionally, the application of these higher volumes of water might successfully be applied through commercially available tooling using methods similar to those used in the deslagging of large utility boilers.

MPW Industrial Services, Inc., has proposed a trial consisting of three approaches each to dislodging both the solid (saltcake) simulant and the sludge simulant.

II. TRIAL PLAN -

Under this proposal, MPW would attempt to dislodge the solid simulant in three 8-foot square x 2-foot deep beds (see Fig. 1 in appendix for pan configurations) with these approaches:

A. Rotary tooling approaching straight down from above the center - four nozzles, 12.5 gpm each at nominal 10,000 psi - 45 degree angle of attack - four-sided box (see Fig. 2 in appendix.)

B. Rotary tooling in at a 45 degree angle from above and to the front, starting at several feet - two nozzles, 25 gpm each at nominal 10,000 psi - three-sided, open front (see Fig. 3 in appendix.)

C. Straight in to the exposed edge of the material with an articulated "water cannon" - flow rates of 25 and 50 gpm at nominal 10,000 psi - three-sided box, open front (see Fig. 4 in appendix.)

The trial points above would be repeated with three pans of sludge simulant, each 4-foot square x 1-foot deep.

Pressures, flow rates, stand-off distances, and a description of the results would be recorded for each trial.

III. SAMPLE PREPARATION -

A. Saltcake - Samples of the hard (salt-cake) simulant were prepared using 720 - 50 lb. bags (18 tons) of potassium/magnesium sulfate "langebeinite", (product trade name "Dynamate", obtained from Ingredient Resource Corp., 1-800-729-7290), per WHC recommendations. Two 3-cubic foot cement mixers were used, mixing at a ratio of 7 bags Dynamate (350 lbs) to 8 gallons of water (66.7 lbs), for a total weight per mix of 416.7 lbs, and a solids ratio of 84 percent.

Each charge was allowed to blend for 20 minutes, after which it was lump-free and homogeneous. 240 bags were used to fill each 8-foot square pan. An electric compactor was inserted at intervals and held for 2-5 seconds, or until the air bubbles ceased to rise. Each pan was covered with plastic and the top of the plastic filled with water, to prevent evaporation during curing.

It should be noted that the original figure of 90 lbs/cubic foot supplied by WHC was incorrect; the 240 bags (12,000 lbs.) filled the 8' x 8' x 2' pans to an approximate depth of 20 inches (1.67 feet), for a dry material weight/cubic foot of 112.3 lbs, and a wet weight density of 133.7 lbs/cubic foot.

Sample mixing began Monday, September 25, and concluded Tuesday, September 26; the trial took place October 10, for a minimum 14-day cure time.

B. Sludge - Samples of the sludge simulant were prepared using 80 - 50 lb. bags of Kaolin Clay ("EPK - Pulverized Kaolin") purchased from Feldspar Corp. (904-481-2421).

The clay was blended at a ratio of 66 percent clay, 34 percent water, by a professional blending company, E.C. Morris, in Wadsworth, Ohio, and returned to MPW in 55-gallon open-top drums.

The resulting mixture was emptied, two drums each, into three pans each 4-foot square x 1-foot deep. It was necessary to use a shovel and hoe to smooth the material, which was the consistency of peanut butter.

IV. TRIAL SET-UP -

A 20-cubic yard roll-off box with 12-feet of the center cut out of one side, and the remaining sides extended up 8-feet, was the choice for a backdrop against which to blast the material. A track was installed horizontally approximately 12-feet above the bottom of the box, in the center of the opening perpendicular to the length of the roll-off box. Rollers were installed on the hangers, permitting the waterblast hose attached to the tooling to move both in and out as well as up and down. See Fig's 5a and 5b in appendix for photos of trial set-up.

Winches were installed to position the tool horizontally, as well as vertically.

StoneAge MJV rotary heads were used, each capable of up to 100 gpm at 10,000 psi, although the trial plan called for flows to only 50 gpm. The original trial plan was to hang these heads from the waterblast hose with a supplementary weight; the stability, with balanced nozzles, would have been adequate for normal cleaning operations, such as that done in large boilers. A typical head set-up is shown in Fig. 6 in the appendix.

All nozzles in the trials are Rankin Shapejets with triangular openings except the 50-gpm water cannon nozzle, which is a standard round (Leach and Walker) carbide nozzle.

A 350 HP waterblast truck unit was staged at the trial site, and fed by a diesel-powered pump from a water supply tank. (This is due to the lack of availability of a 50 gpm water supply close to the trial site.) A hand-held tachometer was used to directly read pump rpm, which equates to flow rate. Fig's. 7a and 7b in the appendix show the truck and water supply configuration.

A high-volume foot pedal was used as the primary pressure relief device.

V. TRIAL EXECUTION AND RESULTS -

Trial No. 1(a) - Solid Simulant -

Trial No. 1 was set up using the 4-sided 8-foot square box shown in Fig. 1A with a nozzle/head configuration as shown in Fig. 2. Results are noted in the following table:

TRIAL 1(a)

Trial Point	"X" Dist.	"Y" Dist.	Time (Sec.)	Results/Comments
1	48"	0	15'	No erosion (outside cutting area)
2	42"	0	30'	" " " " "
3	36"	0	30'	" "
4	21"	0	30'	" "
5	15"	0	30'	" "
6	10"	0	30'	" "
7	4"	0	30'	" " - dropped to 1-2 inches while running - still no erosion - see photo, Fig. 8

No. of nozzles - 4
Pump RPM - 465
Total flow rate - 56.4 gpm
Flow rate per nozzle - 14.1 gpm
Pump Pressure - 9500 psi
Estimated nozzle pressure - 8000 psi

Trial No. 1(b) - This was a continuation of Trial 1(a) above, with the cleaning head being changed to two nozzles, each at a nominal 25 gpm.

TRIAL NO 1(b)

Trial Point	"X" Dist.	"Y" Dist.	Time (Sec.)	Results/Comments
1	0	1"	30'	No erosion

No. of nozzles - 2
Pump RPM - 420
Total flow rate - 50.9 gpm
Flow rate per nozzle - 25.4 gpm
Pump Pressure - 10,000 psi
Estimated nozzle pressure - 8500 psi

Trial No. 2(a) - **Solid Simulant -**

Trial No. 2 was set up using a 3-sided 8-foot square box shown in Fig. 1B with nozzle/head configuration as shown in Fig. 3 - See photo, Fig. 9.

As the pressure drop in the 1/2" waterblast hose was calculated to be approximately 1400 psi at 50 gpm, at this point in the trial it was decided to change to 1-inch hose; this would present a negligible pressure drop, thereby increasing nozzle pressure.

Results are as noted in the following table:

TRIAL NO 2(a)

Trial Point	"X" Dist.	"Y" Dist.	Time (Sec.)	Results/Comments
1	12"	12"	90'	Tool lifts when pressure is applied due to contraction of hose; tool was lowered after start-up to where nozzle streams hit corner of material - no erosion

No. of nozzles - 2
Pump RPM - 420
Total flow rate - 50.9 gpm
Flow rate per nozzle - 25.4 gpm
Pump Pressure - 10,000 psi
Estimated nozzle pressure - 9900 psi

Trial No. 2(b) -

Up to this point, as mentioned previously in this report, the tool had been allowed to swing free from the hose, as is done in some cleaning operations; however, it was felt the lack of repeatedly cutting into the same path contributed to our inability to break up the hard simulant.

Therefore, it was decided to fix the tool to a stationary crossmember - this more rigid attachment could be reasonably duplicated in the actual cleaning of a tank. The rest of this trial is executed with this configuration. See photos, Fig. 10 and Fig. 11.

TRIAL 2 (b)

Trial Point	"X" Dist.	"Y" Dist.	Time (Sec.)	Results/Comments
1	0	12"	30'	Fixed nozzle - framework slipped and head leaned over toward front; material eroded where nozzle hit in front. See photo, Fig. 12.
2	0	6"	30'	Starting to cut; 1/2" - 3/4" deep; see photo, Fig. 13.
3	0	6"	90'	Small chunks of material starting to fly; cut depth 1" - 2"; average depth 1-1/2"; see photo, Fig. 14.
4	0	3"	90'	Material flying - chips 1" - 1-1/2" in size - average 2" depth.
5	0	1-1/2"	90'	Continued cutting in and down - depth 2-4"; see photo, Fig. 15.

No. of nozzles - 2
Pump RPM - 420
Total flow rate - 50.9 gpm
Flow rate per nozzle - 25.4 gpm
Pump Pressure - 10,000 psi
Estimated nozzle pressure - 9900 psi

Trial No. 2(c)

At this point, it was impractical to lower the nozzle further, as the nozzle configuration would not permit lowering. The decision was made to change back to the 4-nozzle configuration to see if the more stationary tooling set-up would permit continuation of the cutting to a greater depth. See photo, Fig. 16. Results, a continuation of Trial 2, are as follows:

TRIAL NO 2(c)

Trial Point	"X" Dist.	"Y" Dist.	Time (Sec.)	Results/Comments
1	0	2"	90'	Some continuation of erosion took place; see photos, Fig's. 17, 18.

No. of nozzles - 4
Pump RPM - 475
Total flow rate - 57.6 gpm
Flow rate per nozzle - 14.4 gpm
Pump Pressure - 10,000 psi
Estimated nozzle pressure - 9900 psi

Trial No. 3(a) - Solid Simulant

Trial No. 3 utilized a "water cannon," as shown in the sketch in Fig. 4. Trial 3(a) used a nominal 25 gpm Rankin Shapejet (triangular) nozzle, while Trial 3(b) used a standard carbide Leach and Walker nozzle at 50 gpm.

TRIAL 3(a)

Trial Point	"X" Dist.	"Y" Dist.	Time (Sec.)	Results/Comments
1	5'	N/A	15'	No effect; see photo, Fig. 19.
2	4'	N/A	30'	" "
3	3'	N/A	30'	Minor erosion; see photo, Fig. 20
4	2'	N/A	30'	More minor erosion; see photos, Fig's. 21, 22.
5	2'	N/A	30'	Work on new spot - some erosion
6	1'	N/A	30'	New spot - some erosion; see photos, Fig's. 23, 24.

TRIAL NO. 3(A) - CONTINUED

7	1'	N/A	30'	Extended time on new spot; see photo, Fig. 25.

No. of nozzles - 1
Pump RPM - 215
Total flow rate - 26.1 gpm
Flow rate per nozzle - 14.1 gpm
Pump Pressure - 9000 psi
Estimated nozzle pressure - 8700 psi

TRIAL 3(b)

Trial Point	"X" Dist.	"Y" Dist.	Time (Sec.)	Results/Comments
1	2'	N/A	90'	Large chunks eroded, to 1-1/2"-3"; see photo, Fig. 26.
2	1'	N/A	30'	Chunk knocked out approx. 18"; see photos, Fig's 27, 28.

No. of nozzles - 1
Pump RPM - 465
Total flow rate - 56.4 gpm
Flow rate per nozzle - 56.4 gpm
Pump Pressure - 9000 psi
Estimated nozzle pressure - 7600 psi

Trial No. 4 - Sludge Simulant

Trial No. 4 consisted of lowering a 4-nozzle head straight down into the center of a 4-foot square, 4-sided pan of sludge simulant.

TRIAL 4

Trial Point	"X" Dist.	"Y" Dist.	Time (Sec.)	Results/Comments
1	0	VARIES	30'	As expected, sludge slurried easily starting with a "Y" distance of 1'. Trial was discontinued at this time with the agreement of the WHC representative, as nothing further was to be learned. See photos, Fig's. 29, 30.

No. of nozzles - 4
Pump RPM - 465
Total flow rate - 56.4 gpm
Flow rate per nozzle - 14.1 gpm
Pump Pressure - 9500 psi
Estimated nozzle pressure - 9400 psi

VI. CONCLUSIONS -

The saltcake simulant turned out have more tensile strength than expected; where it was thought that hitting it with a high volume of high pressure water would open up natural cracks in the material, this did not happen. Where concrete breaks down in hydrodemolition by eroding the interface between cement and aggregate, there are not interfaces of this nature in this simulant; the product is very cohesive, and the bonds appear to be more difficult to break.

While a machining action such as effected by the University of Missouri - Rolla trials appears to be more appropriate for this material, as would the stronger cutting actions of ultrahigh pressure jetting (30,000 psi and higher), the effective standoff distances decrease significantly over the goals of this demonstration.

Possible reasons for the difficulties in breaking down the material, other than it possibly being an exceptionally strong sample compared to previous simulant samples, are as follows:

1. The angle of attack of the rotary tooling - a nominal 45 degrees - was too great, resulting in a glancing action against the hard material.

2. The use of larger volumes perhaps results in a less precise force on the material; an analogy would be the use of a butter knife as opposed to a surgeons scalpel to open up the bond within the material. This parallels our experience in hydrodemolition at 20,000 psi, where a nozzle at 21 gpm has been demonstrated to be superior in some cases to one at 43 gpm in breaking the cement-aggregate bond.

Suggestions for follow-up trials with the already-existing simulant beds are as follows:

1. Increase volumes to 100 gpm at 10,000 psi. This would mean a minimum of 25 gpm in a four-nozzle configuration, and up to 100 gpm in a water cannon arrangement. (Note that the water cannon at 100 gpm would represent 200 gpm in an actual tank retrieval, considering the opposing nozzle, unless an arm capable of a 500-600 pound reactive force is used.)

2. Use a rotary tool with radial nozzles 90 degrees to the axis of the tool, resulting in an angle of attack moving through 90 degrees to the material.

3. Use a polymer additive, resulting in a more focused nozzle pattern, and therefore increased force/unit area to separate the material. The proposed polymer is biodegradable and non-hazardous.

4. Use hot water - to 180 degrees - to blast the material at the pressures and volumes used in this demonstration.

5. Use 20,000 psi, which is usually the pressure used for hydrodemolition of concrete.

The above approaches all constitute approaches now in commercial use by MPW Industrial Services, Inc.

It also should be noted that it is unlikely that the simulant is a true representation of the material in the tanks at Richland; it is suspected that the actual material lacks the monolithic, homogenous nature of the simulant as seen in this demonstration. A true simulation of the in-ground material would most probably offer stress cracks and other interfaces and areas of lower strength which would permit a process of blasting the material apart a greater opportunity of success.

APPENDIX

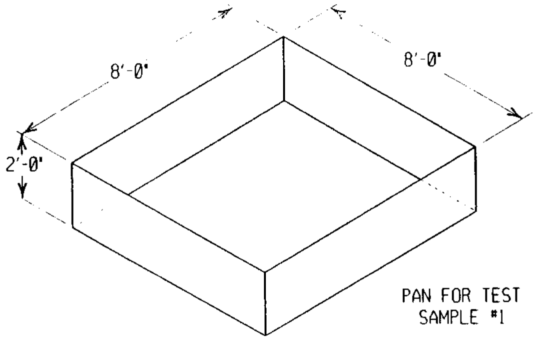


FIG. 1A

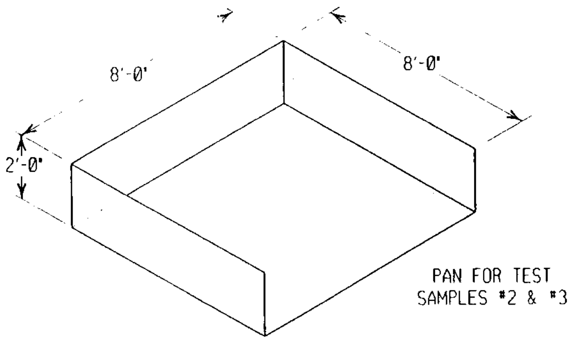


FIG. 1B

FIG. 1

MPW INDUSTRIAL SERVICES, INC.

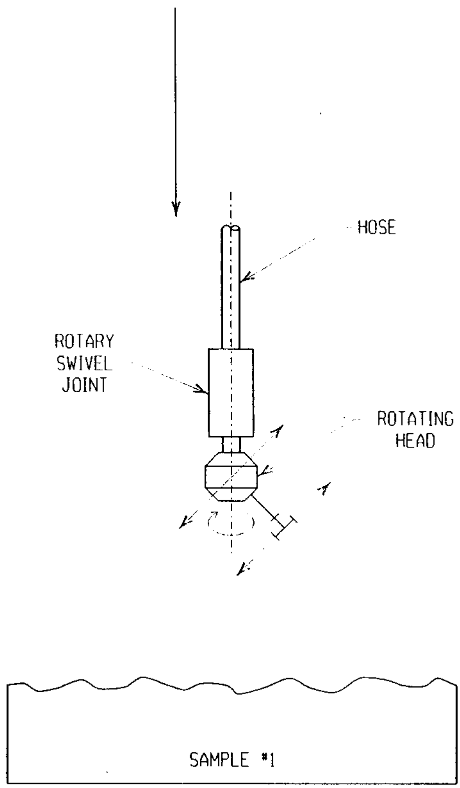


FIG. 2

TRIAL #1

CONFINED SIMULANT-
ROTARY HEAD

MPW INDUSTRIAL SERVICES, INC.

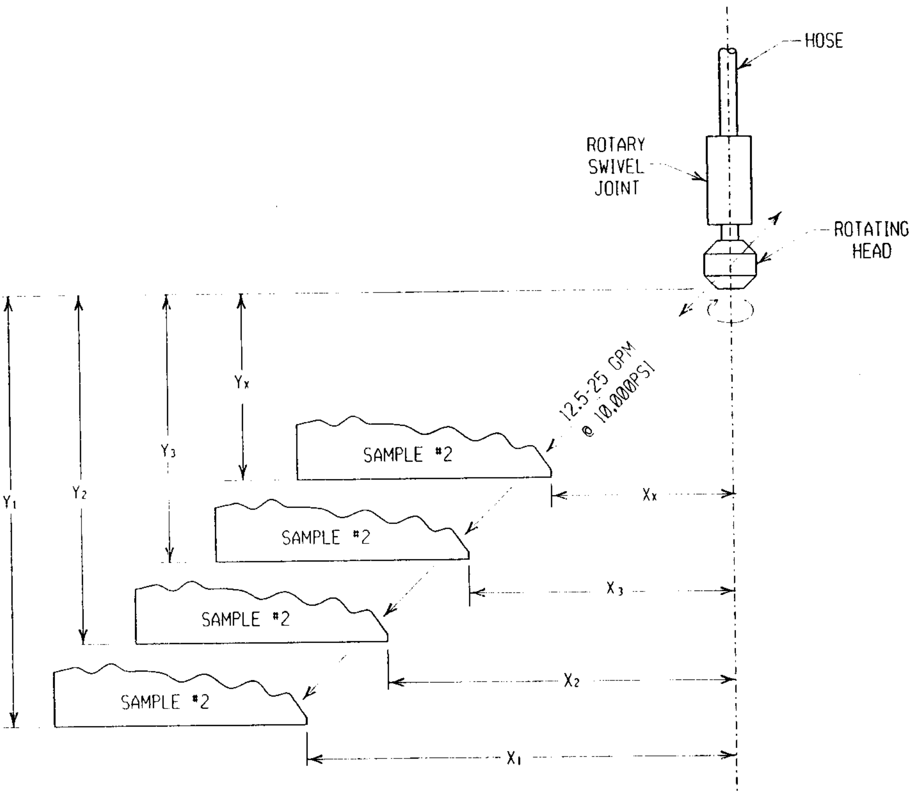
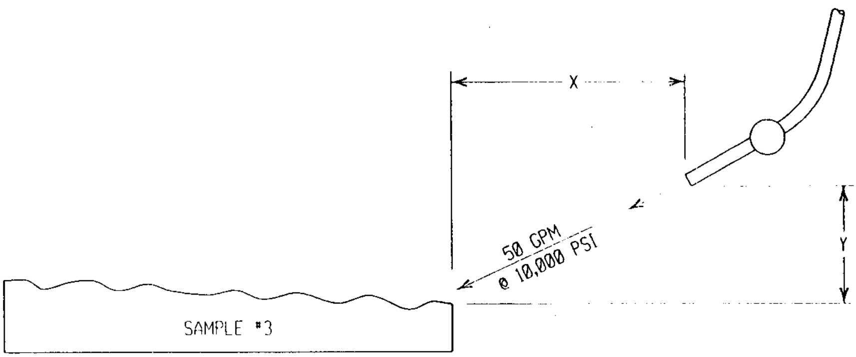
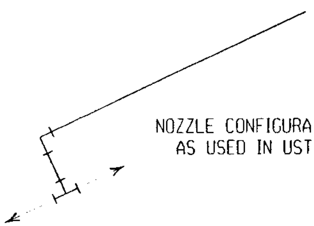


FIG. 3

TRIAL #2
UN-CONFINED SIMULANT-
ROTARY HEAD

MPW INDUSTRIAL SERVICES, INC.





NOZZLE CONFIGURATION
AS USED IN UST'S

FIG. 4

TRIAL #3

UN-CONFINED SIMULANT-
FIXED NOZZLE

INDUSTRIAL SERVICES, INC.

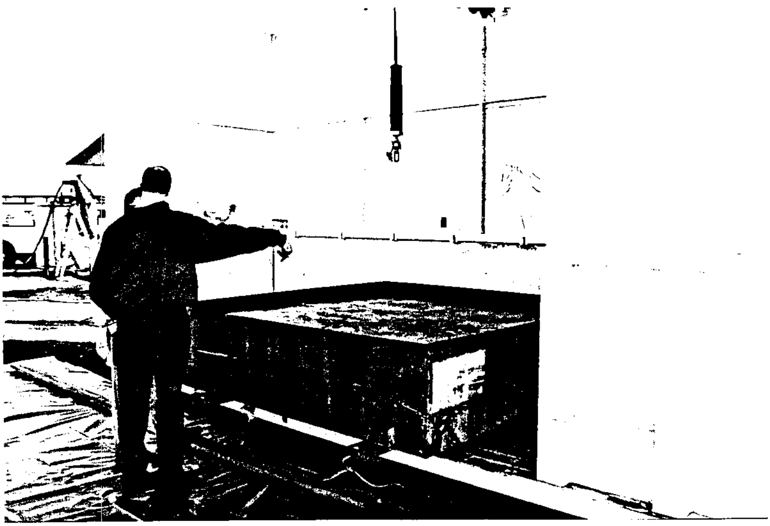


Fig. 5(a) - Roll-off box enclosure to prevent scatter of material and permit close-up viewing.

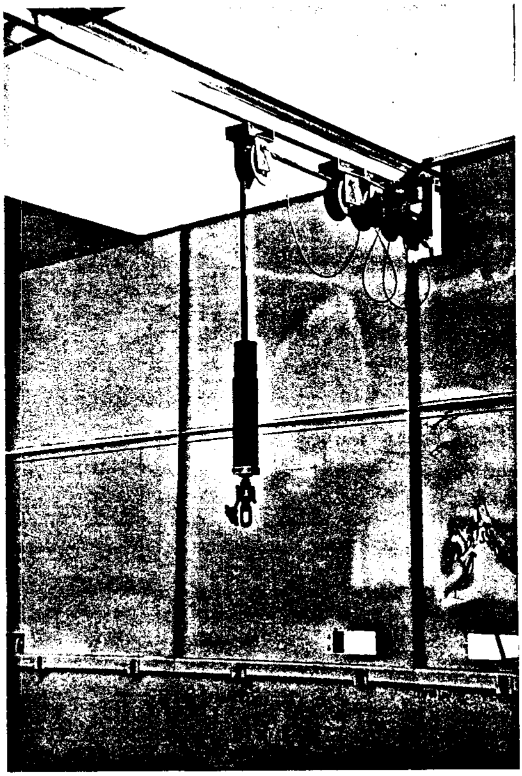


Fig. 5(b) - Rotary tooling suspended on end of hose, with roller arrangement for positioning tool in "x" and "y" directions.

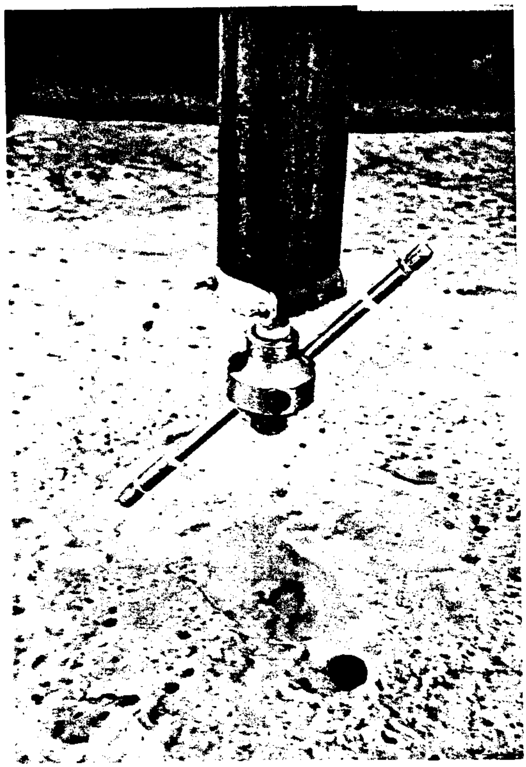


Fig. 6 - StoneAge rotary head, with nozzle extentions and weight

Fig. 7(a) - Waterblast truck unit (right) and supply pump (left).

Fig. 7(b) - Water supply tank.

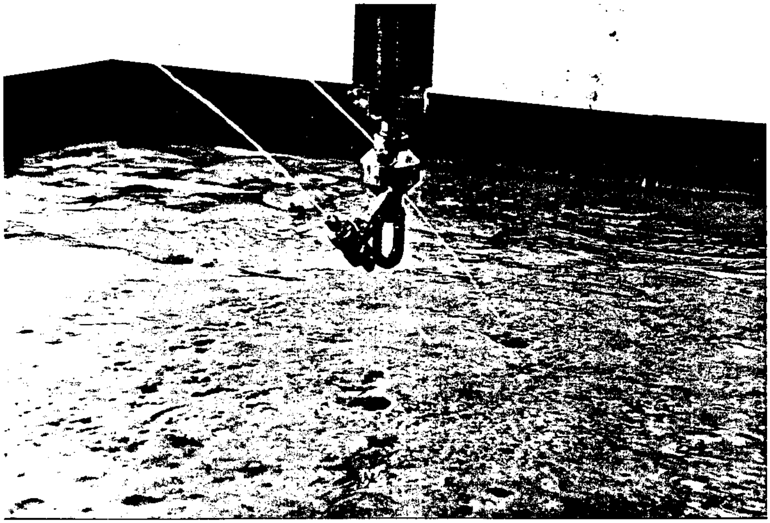


Fig. 8 - Results of 4-nozzle head at "y" distances down to to 1"-2". While some soft areas may have been blasted out, no pattern exists.

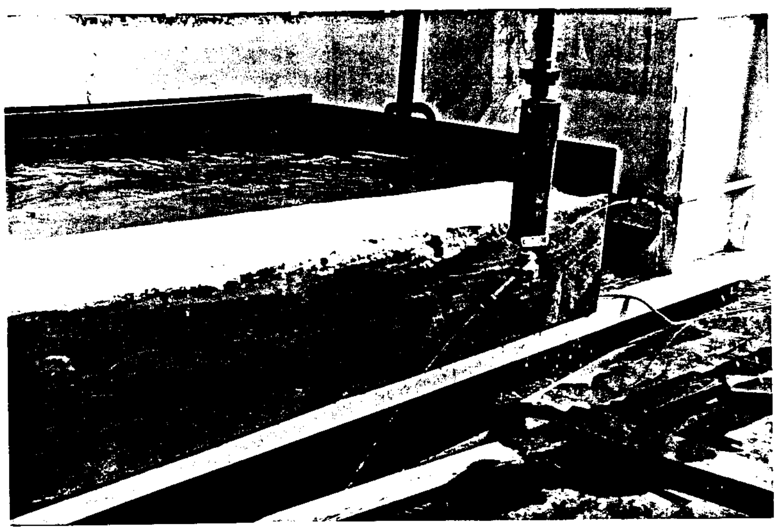


Fig. 9 - Trial No. 2(a) set-up - 2-nozzle head, open front-box

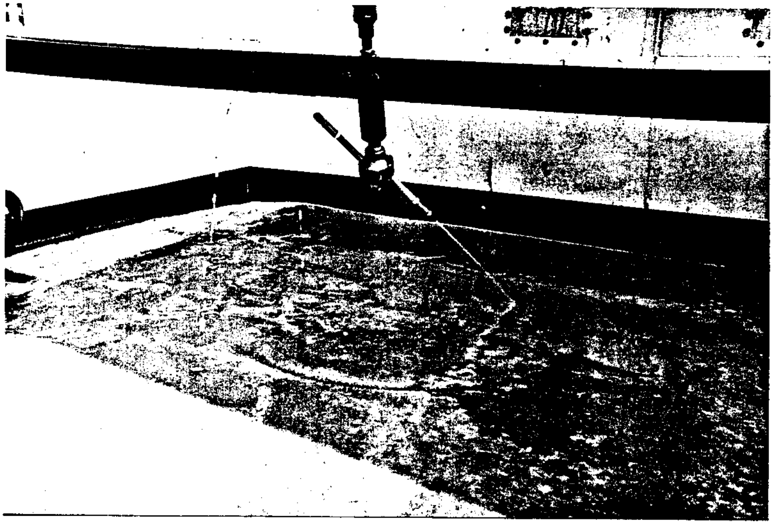


Fig. 10 - Trial 2(b) set-up, showing fixed tool configuration.

Fig. 11 - Trial 2(b), showing execution of fixed-tooling demo.

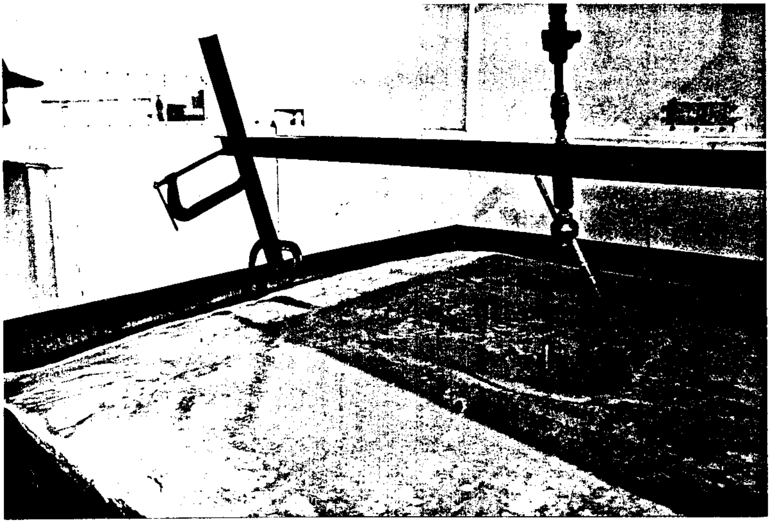


Fig. 12 - Trial 2(b) results - tooling slipped forward, eroded area where nozzle was closest to surface

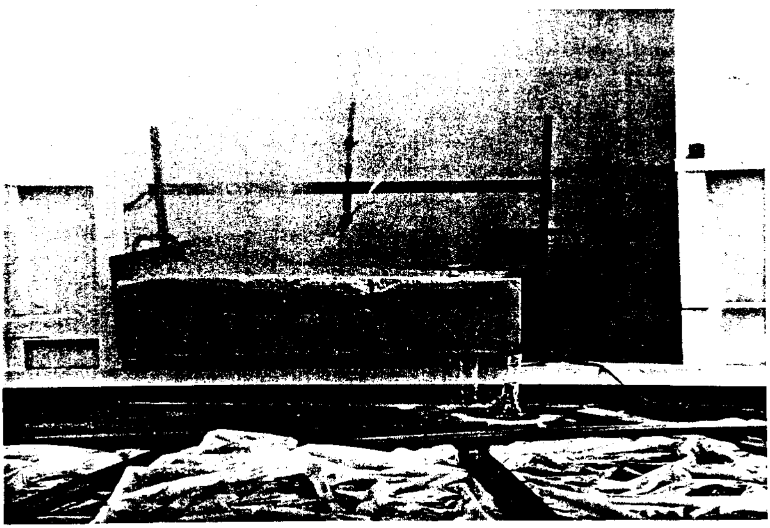


Fig. 13 - Trial 2(b) execution - "y" distance = 6"

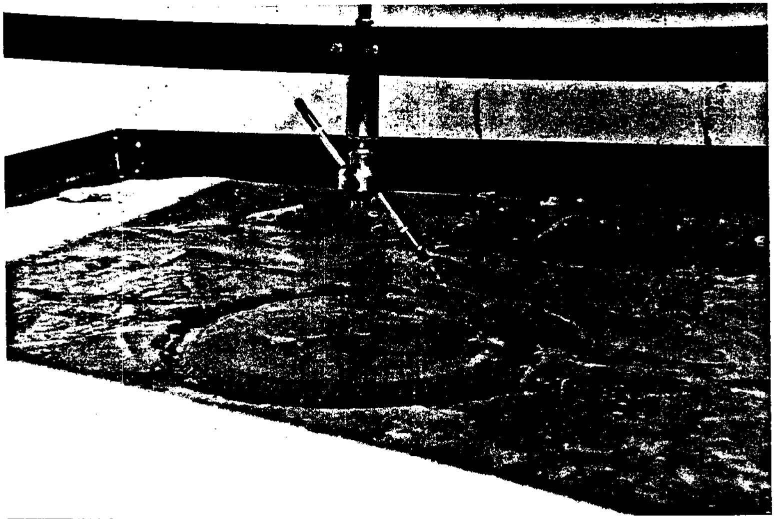


Fig. 14 - Results of extended time (90 seconds) at 6" level, Trial 2(b)

Fig. 15 - Results of 90 seconds at 1-1/2" "y"-distance

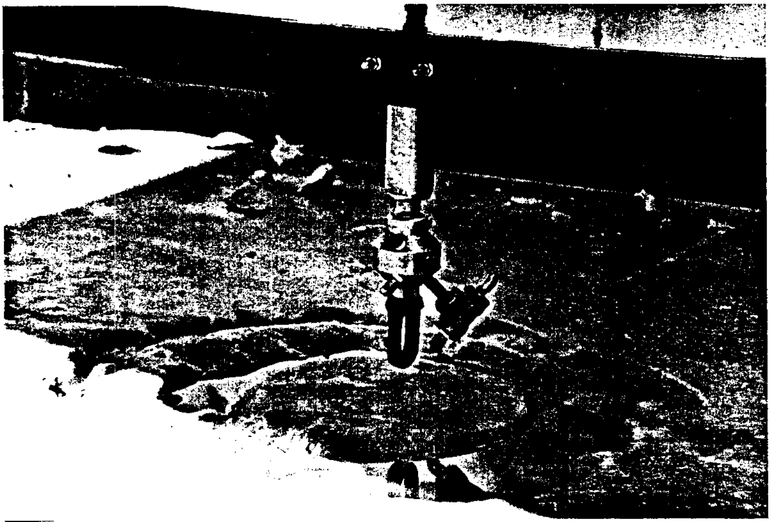


Fig. 16 - Preparation for Trial 2(c), 4-nozzle head

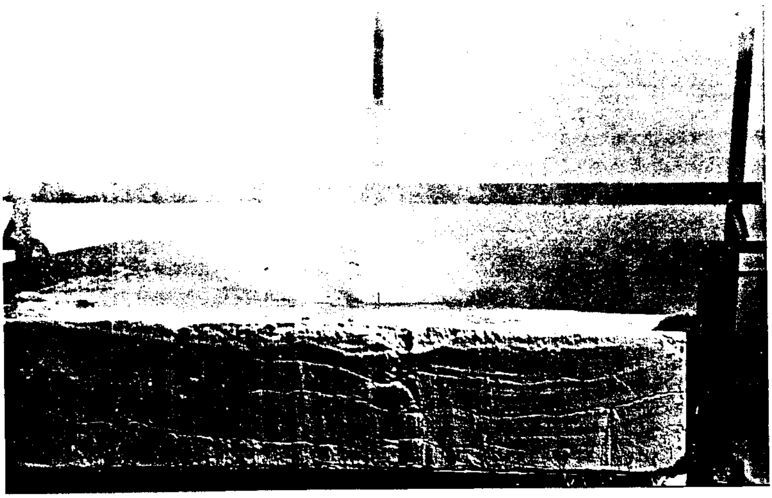


Fig. 17 - Trial 2(c) - 2" "y"-distance

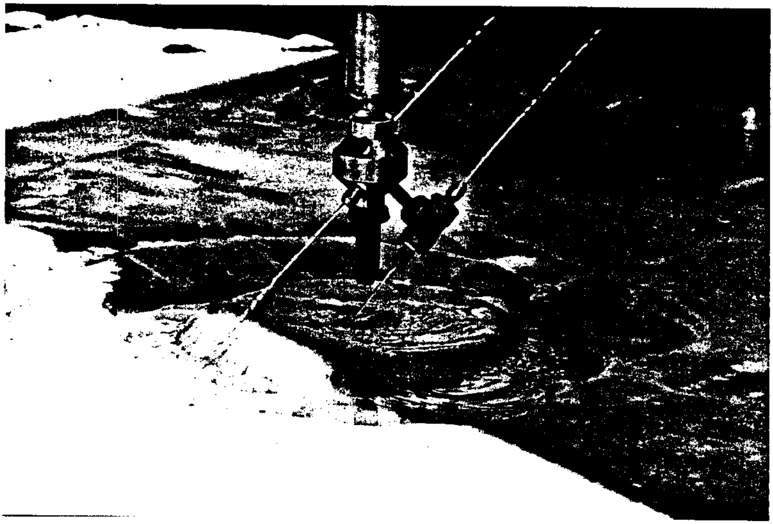


Fig. 18 - Results of Trial 2(c) - additional removal

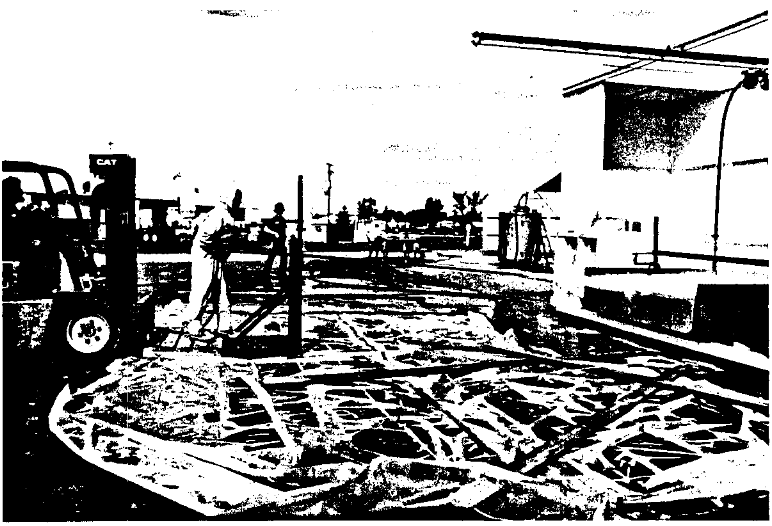


Fig. 19 - Trial 3(a) water cannon in use at 5-foot stand-off distance

Fig. 20 - Trial 3(a) - Results of 30 seconds at 3-foot stand-off distance

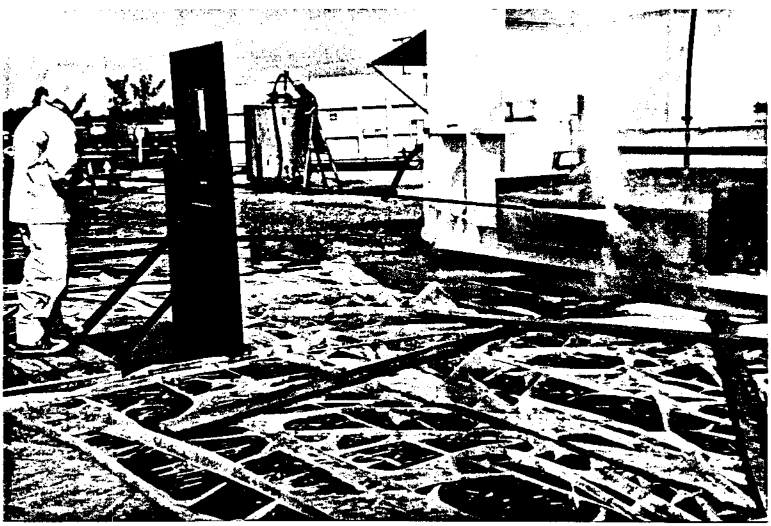


Fig. 21 - Trial 3(a) - Execution at 2-foot stand-off distance

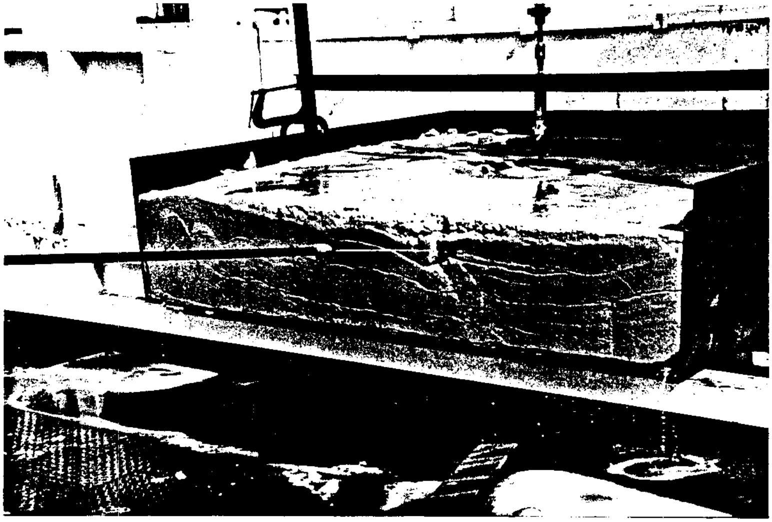


Fig. 22 - Trial 3(a) - Results at 2-foot stand-off distance

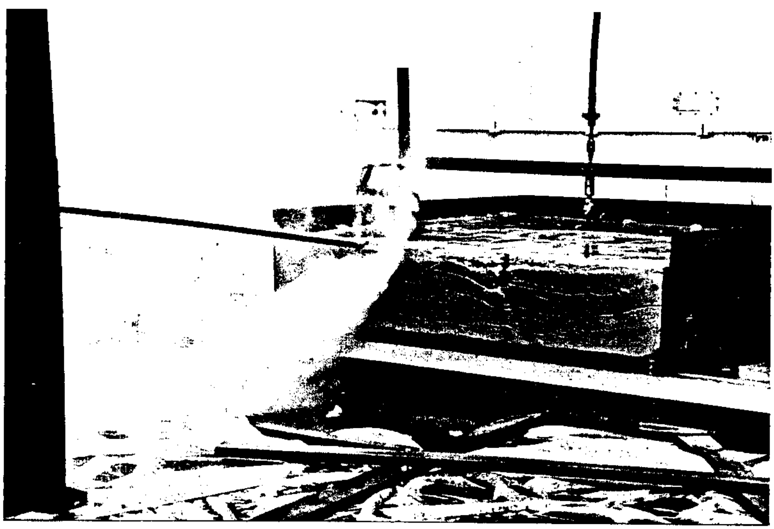


Fig. 23 - Trial 3(a) - Execution at 1-foot stand-off distance

Fig. 24 - Trial 3(a) - Results at 1-foot stand-off distance

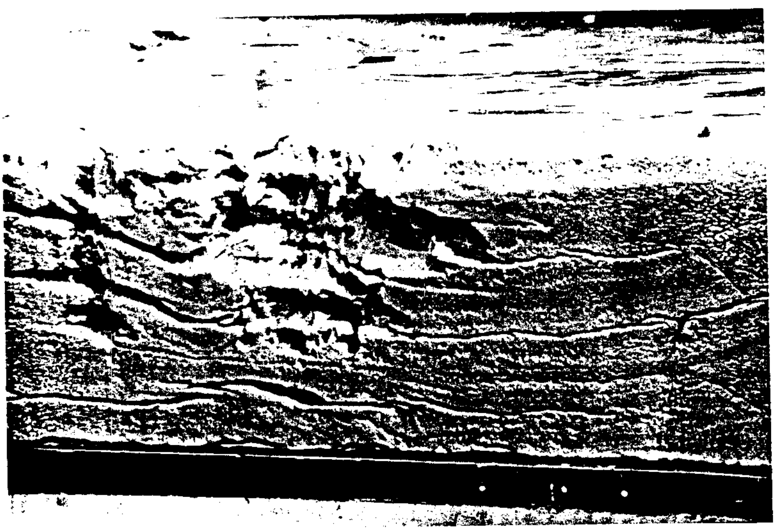


Fig. 25 - Trial 3(a) - Results of extended time (90 seconds) at 1-foot stand-off distance

Fig. 26 - Trial 3(b) - Results showing chunks blown out at 56.4 gpm, 2-foot stand-off distance

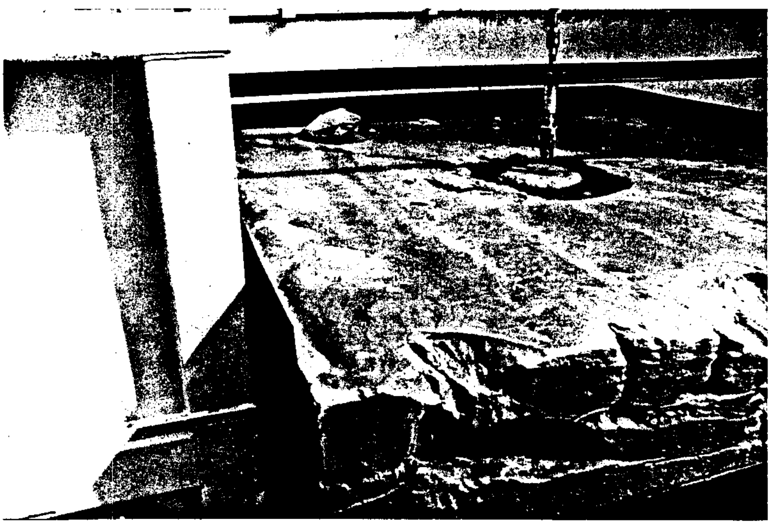


Fig. 27 - Large chunk knocked out during Trial 3(b) - 1-foot stand-off distance

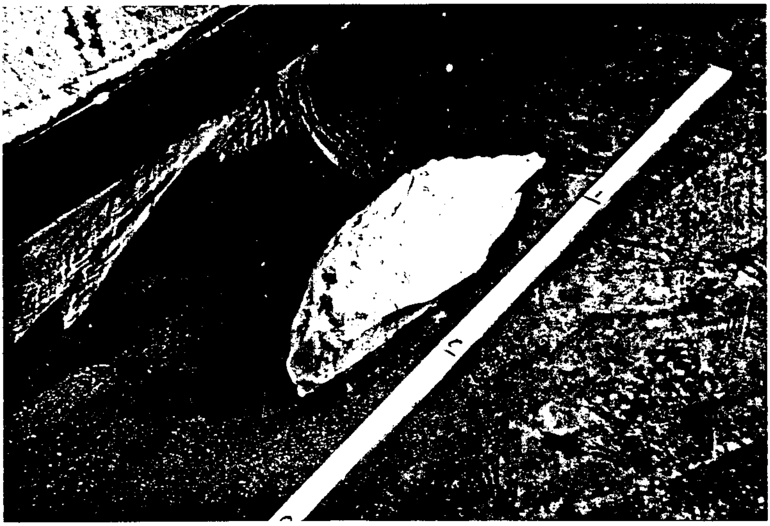


Fig. 28 - Trial 3(b) - Size comparison - chunk approximately 18" long - 1-foot stand-off distance

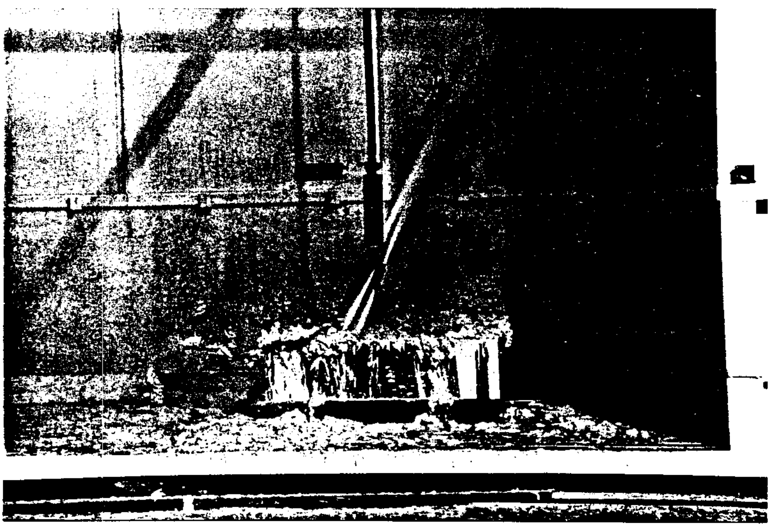


Fig. 29 - Execution of Trial 4 (sludge simulant)

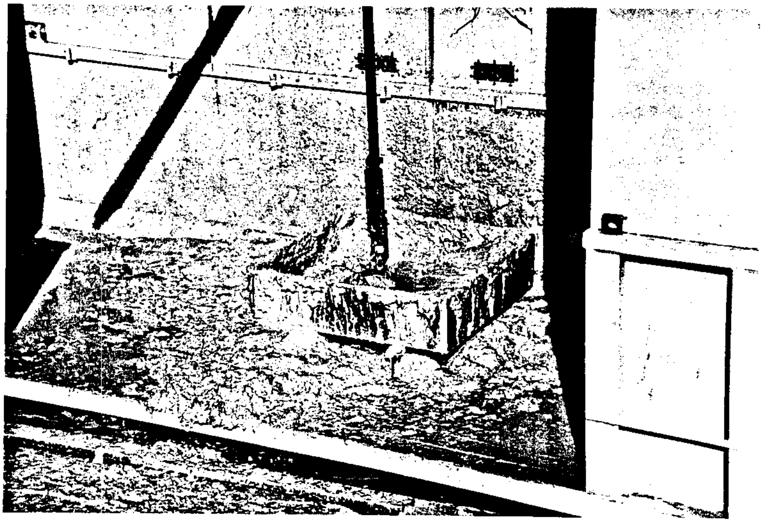


Fig. 30 - Results of Trial 4 - sludge simulant

Feldspar CORPORATION **MATERIAL SAFETY DATA SHEET**

Suite 700, 1 West Pack Square, Asheville, N.C. 28801 • (704) 254-7400 • FAX: (704) 255-4909

SECTION I. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: EPK KAOLIN

CHEMICAL NAME: Kaolinite (CAS No. 1332-58-7)

PRODUCER:
The Feldspar Corporation
One West Pack Square- Suite 700
Asheville, NC 28801

TELEPHONE NUMBERS:
(Emergency and Information)
(704) 254-7400 8am-5pm EST M-F
(704) 255-4909 FAX

MSDS No. 9304 DATE PREPARED: August 2, 1993

SECTION II. HAZARDOUS INGREDIENTS

Free Silica (Crystalline Quartz) Formula: SiO_2 Typically 0.1-4% CAS No. 14808-60-7

Kaolin or kaolinite is a naturally occuring hydrous aluminum silicate mineral. Formula: $H_4Al_2Si_2O_9$; SiO_2

SECTION III. PHYSICAL DATA

BOILING POINT: Not Applicable VAPOR PRESSURE: Not Applicable SPECIFIC GRAVITY: 2.56

MELTING POINT: 1740-1785°C SOLUBILITY IN WATER: Negligible PERCENT VOLATILE: Not Applicable

ODOR AND APPEARANCE: Earthy smell when wet. White to light gray lumps; buff-colored powder.

SECTION IV. FIRE AND EXPLOSION DATA: Non-flammable and non-explosive.

SECTION V. HEALTH HAZARD INFORMATION

OSHA PEL: CRYSTALLINE QUARTZ (Respirable) 0.1 mg/m^3 (TWA-TLV)
ACGIH TLV: CRYSTALLINE QUARTZ (Respirable) 0.1 mg/m^3 (TWA-TLV)

HAZARD BY ROUTES OF EXPOSURE:

INHALATION: **WARNING:** These products contain crystalline silica. Repeated, prolonged inhalation of dust may cause delayed lung injury which may result in silicosis or pneumoconiosis. The International Agency For Research On Cancer in its publication, *"IARC Monographs On The Evaluation Of The Carcinogenic Risk To Humans - Silica and Some Silicates"* - Volume 42, 1987, has concluded that there is sufficient evidence for the carcinogenicity of crystalline silica in experimental animals, and limited evidence for the carcinogenicity of crystalline silica in humans, and has, therefore, classified crystalline silica in Group 2A of Probable Carcinogens. The National Toxicology Program's ("NTP's") Sixth Annual Report on Carcinogens lists crystalline silica (respirable) as a substance which may reasonably be anticipated to be a carcinogen. In support of this listing, NTP cited the IARC conclusions mentioned above. The animal studies found increased tumors in rats resulting from inhalation, intratracheal instillation, and interpleural or intraperitoneal injection. In humans, a number of studies have found an association between lung cancer and exposure to dust containing respirable crystalline silica. These studies only rarely, however, included data on smoking, potential confounding exposures, and assurance of the comparability of the referent population.

INGESTION: Nausea may result from accidental ingestion. May cause cancer, based on animal data.

SECTION V. HEALTH HAZARD INFORMATION (Continued)

EYE: Inflammation of eye tissue may occur from overexposure.

SKIN CONTACT/ABSORPTION: Inflammation from contact with open cuts may occur.

SIGNS AND SYMPTOMS ASSOCIATED WITH EXPOSURE OVER THE TLV:
Short Term: Shortness of breath, caughing associated with inhalation of dust. Long Term: May cause silicosis, a chronic disease of the lungs marked by acute fibrosis; may cause cancer, based on animal data.

EMERGENCY/FIRST AID PROCEDURES:

INHALATION: Move to fresh air; consult physician and /or obtain competent medical assistance as necessary.

INGESTION: Consult physician and/or obtain competent medical assistance.

EYE CONTACT: Flush with water; consult physician and/or obtain competent medical assistance as necessary.

SKIN CONTACT: Wash thoroughly with water.

SECTION VI. REACTIVITY DATA

STABILITY: Kaolin is a stable material under ordinary conditions.

INCOMPATIBILITY: None known.

HAZARDOUS POLYMERIZATION: Not known to occur.

SECTION VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS SPILLED OR RELEASED:
If uncontaminated, recover and reuse. If contaminated, collect in suitable containers for disposal. Use appropriate method to avoid creating dust. Avoid breathing dust. Wear a NIOSH/MSHA/OSHA approved respirator.

WASTE DISPOSAL METHOD: May be buried in approved land disposal facility in accordance with Federal, State, and local regulations. Kaolin is not a hazardous waste under RCRA (40 CFR Part 261). Kaolin is not regulated by DOT.

SECTION VIII. CONDITIONS FOR SAFE USE

VENTILATION: Local exhaust required for dust removal. Refer to OSHA 1910.24, ASTM, and/or ANSI Standards. Do not exceed OSHA PEL or ACGIH TLV.

RESPIRATORY PROTECTION: Use NIOSH/MSHA/OSHA approved respirator if dust is present.

EYE PROTECTION: Optional, but recommended.

PROTECTIVE GLOVES: Optional, but recommended.

SECTION IX. SPECIAL PRECAUTIONS

1. Do not breathe dust.
2. Avoid creating dust in closed areas.
3. Use adequate ventilation as recommended by NIOSH/MSHA/OSHA for crystalline silica.

MALLINCKRODT
Feed Ingredients

421 E. HAWLEY STREET
MUNDELEIN, ILLINOIS 60060
708-949-3300

MATERIAL SAFETY DATA SHEET
DYNAMATE®

SECTION I. PRODUCT INFORMATION

PRODUCT NAME:	*DYNAMATE®*	CAS NO.:	*14977-37-8*
CHEMICAL FAMILY:	Inorganic Salt	MOLECULAR WEIGHT:	415
CHEMICAL NAME:	Potassium Magnesium Sulfate	FORMULA:	$K_2SO_4 \cdot 2MgSO_4$
DOT CLASS:	Not regulated by DOT		

SECTION II. COMPOSITION

COMPOSITION	%	CAS. NO.
Potassium Magnesium Sulfate	97.3	14977-37-8
Chloride Salts	2.1	-
Insoluble	0.5	-
Moisture	0.1	7732-18-5

Dynamate® is not classified as a hazardous material by the criteria of the OSHA Hazard Communication Regulation, 29, CFR Part 1910, .1910.1200, "Hazard Communication"

SECTION III. PHYSICAL DATA

MELTING POINT:	1700° F	SPECIFIC GRAVITY:	(H_2O = 1) 2.83
VAPOR PRESSURE, (mm Hg):	Not Applicable	PERCENT VOLATILE:	Not Applicable
SOLUBILITY IN WATER (77° F):	24.4%		
APPEARANCE AND ODOR:	Tan odorless granules		

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Dynamate® is a non-flammable inorganic salt. It will not support combustion, and is non-hazardous. When subjected to temperatures above 1000°F, it may release small amounts of sulfur oxides..

SECTION V. REACTIVITY DATA

STABILITY:	Dynamate® is stable under all normal conditions.
INCOMPATIBILITY (materials to avoid):	None
HAZARDOUS POLYMERIZATION:	Will not occur.

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ECTION VI. HEALTH HAZARD DATA

OSHA Permissible Exposure Limit or TLV - None established. We suggest the OSHA nuisance dust limit of 15 g/m^3 or the ACGIH TLV of 10 mg/m^3 as total dust.

OUTES OF ENTRY: Lungs (Breathing), ingestion (swallowing)

TOXICITY DATA: None found.

EFFECTS OF OVEREXPOSURE:

SHORT TERM: None found. No information found. Due to its similarity to potassium sulfate and magnesium sulfate (Epsom Salts), it is possible that large doses of Dynamate® may cause vomiting, severe gastrointestinal irritation, and diarrhea.

LONG TERM: None known. Dynamate® is used as an animal feed additive.

FIRST AID: *Eyes* - Flush thoroughly with water. If pain or discomfort persists, see a physician.
Skin - Wash thoroughly with water.

ECTION VII. SPILL, LEAK AND DISPOSAL INFORMATION

TEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED;

If uncontaminated, sweep up or collect, and reuse as product. If contaminated with other materials, collect in suitable containers.

WASTE DISPOSAL METHOD: Uncontaminated material can generally be disposed of in an approved land disposal facility, in accordance with applicable federal, state, and local regulations. Depending upon type and extent of contamination, if any, other disposal methods may be required by environmental regulatory agencies.

ECTION VIII. SPECIAL PROTECTION INFORMATION

ESPIRATORY PROTECTION: If dust concentrations exceed recommended Permissible Exposure Limits, use IOSH-approved dust respirators, with approval TC-21C-xxx, until feasible engineering controls are completed.

VENTILATION: Local exhaust or other ventilation that will reduce dust concentrations to less than Permissible xposure Limits is recommended.

YE PROTECTION: If high dust concentrations exist, tight-fitting goggles are recommended to reduce dust exposure to the eyes.

THER PROTECTIVE EQUIPMENT: Optional.

SECTION IX. SPECIAL PRECAUTIONS

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November, 1994
(Revised)

INGREDIENT RESOURCE TEL NO.502-448-0516 Oct 20.95 11:16 No.005 P.02

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