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# DEVELOPMENT OF A GEOMETRICALLY FAVORABLE CANYON DISSOLVER

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## INTRODUCTION

SAVANNAH RIVER PLANT HAS HISTORICALLY USED ADMINISTRATIVE CONTROLS TO PREVENT NUCLEAR CRITICALITY IN CANYON DISSOLVERS.

SAVANNAH RIVER LABORATORY HAS BEEN DEVELOPING A GEOMETRICALLY FAVORABLE DISSOLVER TO IMPROVE THE NUCLEAR SAFETY OF DISSOLVING OFFSITE FUELS OR SCRAP (WHICH HAVE HIGH FISSILE CONTENT).

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## DESCRIPTION

THE ILLUSTRATION SHOWN IS THE PROTOTYPE WHICH HAS BEEN CONSTRUCTED FOR INITIAL FULL–SCALE EVALUATION USING NONFISSILE MATERIALS. THERE ARE FOUR CHARGING PORTS, 6 INCHES IN DIAMETER, CONNECTED TO A 3–INCH ANNULUS. THE FUEL ELEMENT OR SCRAP WOULD BE LOADED INTO DISPOSABLE CONTAINERS, WHICH WOULD BE CHARGED TO THE DISSOLVER PORTS. FOR HIGH FISSILE MATERIAL, ONLY THE BOTTOM FOUR FEET OF THE CONTAINER WOULD BE USED, COMPLETELY ISOLATING THE FISSILE MATERIAL IN A 6–INCH WELL BELOW THE ANNULUS.

RECIRCULATION AND MIXING ARE PROVIDED WITH A CENTRAL AIR LIFT WHICH IS CAPABLE OF RECIRCULATING 50 TO 100 GALLONS PER MINUTE. DISSOLVER SOLUTION FLOWS UP THE CENTRAL AIR LIFT PIPE, DOWN A CONICAL SPILLWAY TO THE ANNULUS. FLOW CONTINUES FROM THE ANNULUS TO THE CHARGING PORTS THROUGH A SERIES OF HOLES IN EACH CHARGING PORT. THE SOLUTION THEN CONTACTS THE CHARGE AND CONTINUES DOWN THE PORTS TO THE CENTRAL AIR LIFT.

## FLOW STUDIES

EXTENSIVE FLOW STUDIES HAVE BEEN DONE ON ONE-EIGHTH, ONE-QUARTER, AND FULL-SCALE MODELS. THE VIDEO TAPE DEMONSTRATES THE FLOW PATTERNS AND MIXING IN THE QUARTER-SCALE MODEL. THESE STUDIES WERE CONDUCTED BY USING AN ACID/BASE COLOR INDICATOR AND OBSERVING THE REACTION WHEN ACID OR BASE WAS ADDED AT VARIOUS POINTS. MIXING TIMES OF $< 2$ MINUTES WERE PREDICTED WITH THE SMALL-SCALE MODELS. THESE PATTERNS AND MIXING TIMES HAVE BEEN CONFIRMED ON THE FULL-SCALE PROTOTYPE USING THIS SAME TECHNIQUE WITH STRATEGICALLY PLACED SIGHT PORTS.

## HEAT TRANSFER

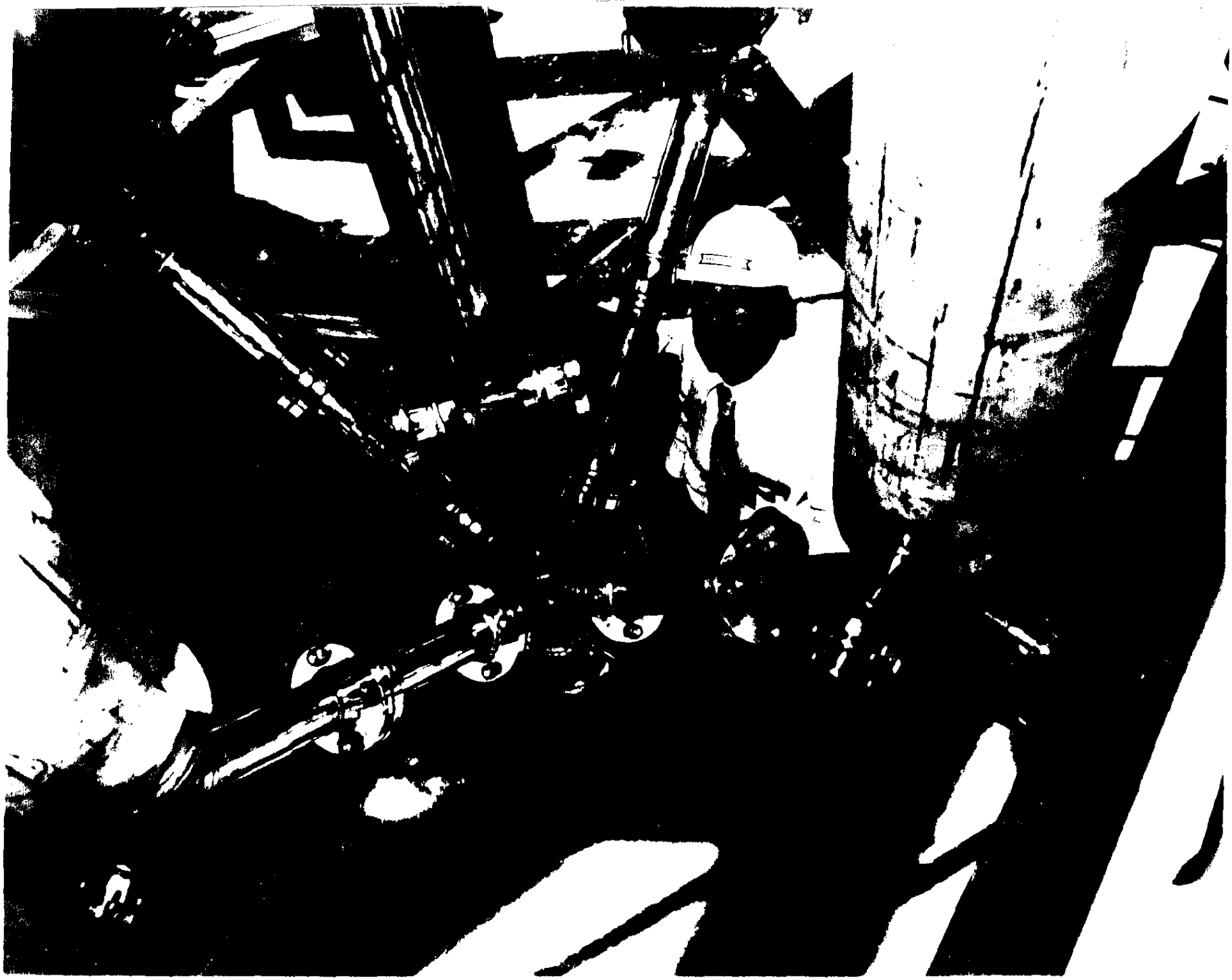
HEAT TRANSFER IS ACCOMPLISHED BY USING HEATING/COOLING COILS IN THE ANNULUS AND JACKETS AROUND THE CHARGING PORTS. HEAT TRANSFER STUDIES WITH THE PROTOTYPE SHOW HEAT UP FROM AMBIENT TO 95°C IN LESS THAN ONE HOUR, USING 150 PSIG STEAM IN THE COILS. COOLING RATES WERE SIMILAR, USING 15°C WATER IN THE COILS AND JACKETS.

## PROGRAM

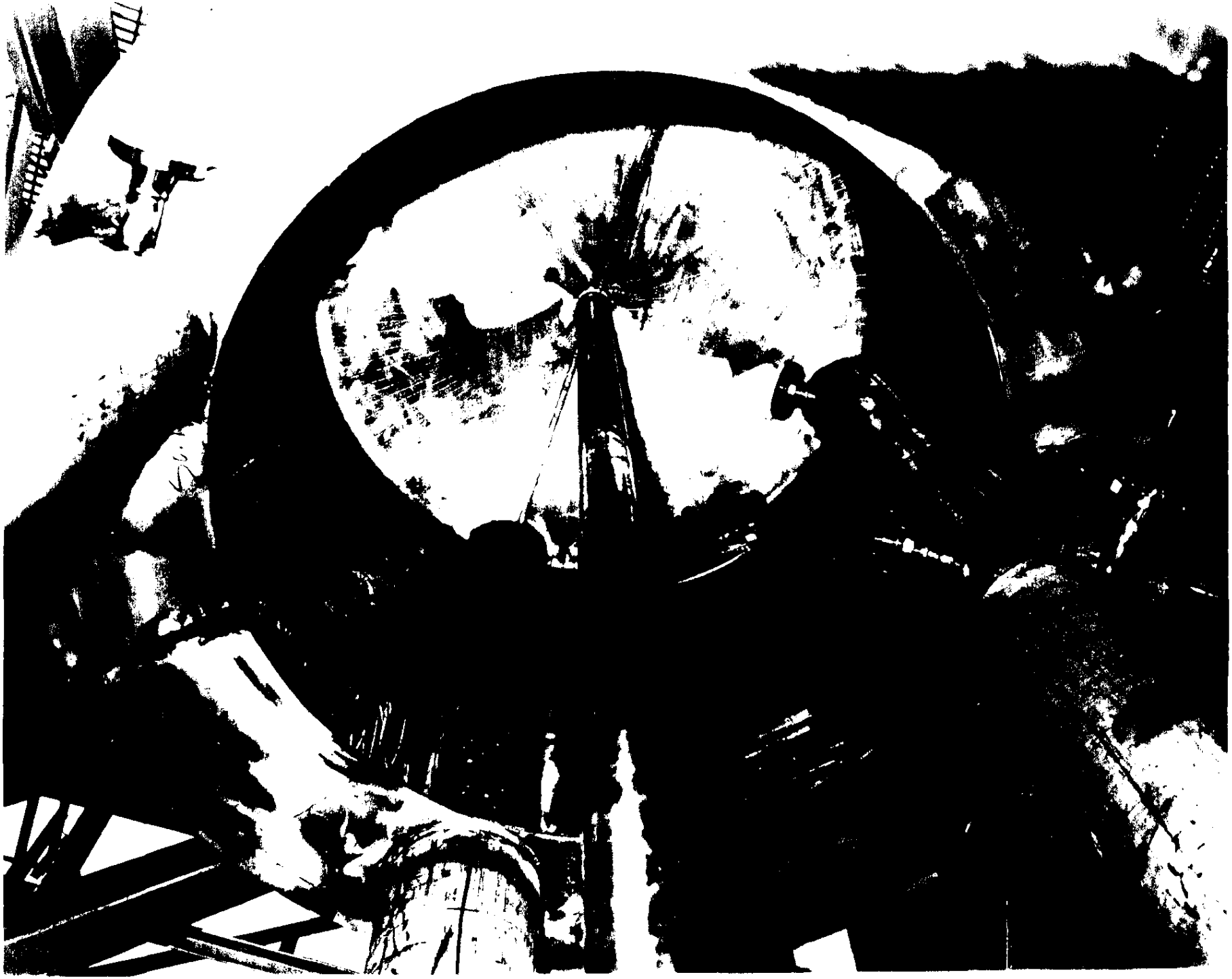
TESTING OF THE PROTOTYPE IS CONTINUING WITH THE FOLLOWING OBJECTIVES:

- DEMONSTRATE ACCEPTABLE HANDLING OF INSOLUBLE MATERIAL (SLUDGES)
- DEMONSTRATE ACTUAL DISSOLUTION WITH DEPLETED URANIUM AND OXIDES
- DEMONSTRATE THE USE OF AN EDUCTOR TO REMOVE AND DILUTE PRODUCT SOLUTION OR SUSPENDED SOLIDS

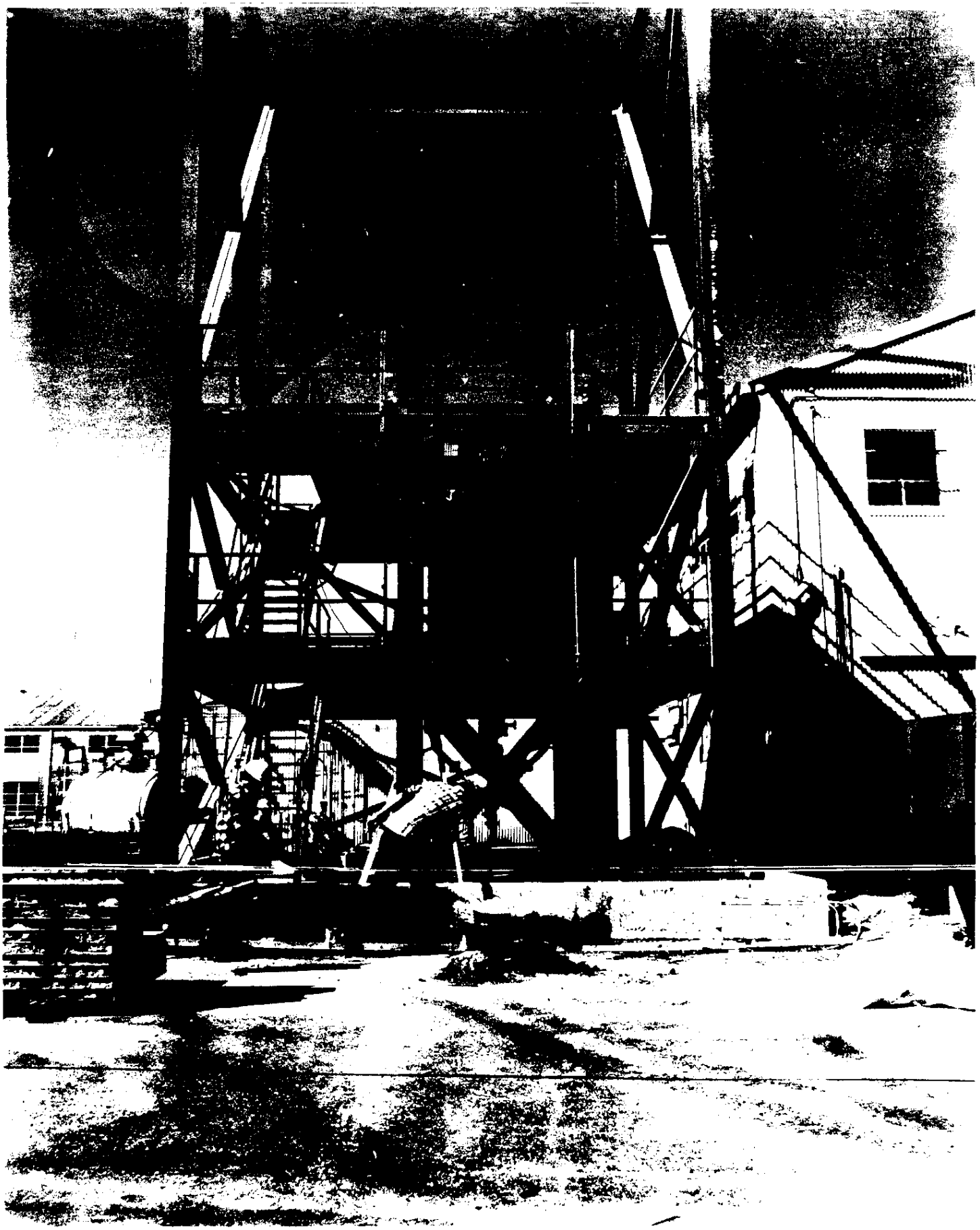
A BASIC DATA REPORT HAS BEEN WRITTEN TO INITIATE DESIGN OF A CANYON DISSOLVER TO BE INSTALLED IN FY 92.



BOTTOM OF PROTOTYPE



INSIDE VIEW FROM GROUND LEVEL



**DISSOLVER INSTALLED IN SUPPORT STRUCTURE**

TOP OF DISSOLVER