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A BIBLIOGRAPHY OF REACTOR HAZARDS

INTRODUCTION

This annotated bibliography contains 109 references to the classified report literature on the liability of reactors to disaster, the possible consequences of disaster, and reactor accidents which have occurred.

The references are arranged alpha-numerically, which is essentially by issuing site. An author index, a subject index, and a report number index are included. The subject index references the reports both by the reactor affected and the potential hazard. The report number index contains both primary and secondary numbers of the reports.

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HAN-50417

Travis, J. E.

"Recommendations of the Reactor Safeguard Committee" (5-22-54)

3 p.

Recommends features to be incorporated into the design of the 100-K reactors and additional studies to be made on various aspects of design and operation to insure greater safety.

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HW-3-2567

Woods, W. K.

"Water Stoppage in Selected Tubes during 105 Unit Shutdown"

(5-28-45) 10 p.

Interruption of water supply to a single tube and to a single horizontal header supplying two adjacent rows of tubes is considered with respect to temperature of the tube wall. Various appendices concerning calculations are attached.

HW-3-2731

Woods, W. K.

"Operation of 105-Units during Critical Power Conditions" (6-19-45)

3 p.

Brief discussion of the attached figure (HW-3-2620) giving relative heat flow and water rate curves following a power failure.

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HW-7-632

Hall, Jane H.

"Review of Reports Concerning Hazards in Event of Catastrophe"
(9-6-44) 2 p.

An outline of information contained in CH-474 and CH-504 is given.

HW-7-635

Hall, Jane H.

"Hazards in Event of Product Being Dispersed" (9-11-44) 4 p.

Calculation of the radiation from a cloud of radioactive gas which is liberated into the air by complete disintegration of the reactor due to a catastrophe.

HW-7-5934

Gamertsfelder, C. C.

"Re: Effects on Surrounding Areas Caused by the Operation of the Hanford Engineering Works" (3-11-47) 10 p.

The possible effects of a reactor explosion on the surrounding territory are discussed with references to calculations that have been made regarding safety limits.

HW-13323

Gross, C. N. and A. B. Greninger

"Review of Certain Hanford Operations - Reactor Safeguard Committee"
(5-10-49) 5 p.

Information requested by the Committee in GEH-14,039 is given. In-pile safety device, seismic wave detection, monitoring of stack gases, and under-ground waste disposal which might contaminate the river are all discussed with emphasis on results of a disaster.

HW-14058

Parker, H. M.

"Hazards Attendant on Storage of Radioactive Waste" (8-2-49) 56 p.

The Hanford reactor is treated as a waste storage unit and disasters such as loss of cooling water, earthquake, bombing, sabotage, reactor runaway, explosion and fire are studied with possible results. Dissemination of radioactivity by air and water is discussed with resulting hazards to fish, crops, animals, and humans.

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HW-15279

Ozeroff, W. J.

"Radiation and Explosion Hazards in the Critical Mass Experiments"
(12-2-49) 9 p.

The design of the reactor used with its "fail safe" features, calculation of the possibility of explosion, and possible radiation damage as a result of explosion are given. This assumes that all safety devices failed to operate.

HW-19267

Gast, P. F.

"Reactor Safety in P-10 Production" (10-26-50) 4 p.

Discussion of the safety of H-Pile as affected by enriched loading for tritium production. A slight gain in reactivity from decay of xenon following shutdown is shown. Reactivity in event of loss of cooling water, decay of xenon, and subsequent heating of uncooled pile by fission products is calculated.

HW-24327

Leonard, B. R., Jr.

"A Study of the Radiation Burst in the Hanford Homogeneous Reactor"
(5-2-52) 30 p.

The history and apparatus of the critical mass experiment are given with a complete analysis of the causes and results of the radiation incident on November 16, 1951. Energy release, temperature rise, activity increase and radiation levels are calculated.

HW-24357

Altman, M.

"Cooling Water Failure in Hanford Piles" (6-2-52) 11 p.

An estimate is made of the temperatures which pile components would reach after a cooling loss based on original power level, length of shutdown before cooling loss, and length of time after cooling loss. In this initial report it is assumed that slugs lose a negligible amount of heat until the melting point of aluminum is reached, that after this point all heat generated in the slugs is transferred to the graphite, and that stored energy in the graphite is released at a uniform rate per degree rise in temperature.

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HW-25575

Healy, J. W. and J. M. Smith

"Coulee Dam Disaster Effects on Hanford Works, Radiological Sciences Department Viewpoint" (9-9-52) 9 p.

Discussion of possible failure of the reactor structure and/or failure of cooling water due to flood conditions. The downstream distribution of irradiated metal and other radiation sources is considered. Possible preventative measures and subsequent monitoring and rehabilitation procedures are outlined.

HW-25892

Roy, G. M., G. L. Locke, E. L. Armstrong and C. Sege

"Summary Report of Reactor Hazards for Twin 100-K Area Reactors" (10-10-52) 118 p.

A complete study of the 100-K areas giving particular attention to hazards. A description of the areas and their operation with a list of safety features of the reactor design is given. Reactor hazards are listed and discussed. The consequences of a reactor runaway in four given cases are studied with respect to effects on the reactor and reactor building. Heat liberation from chemical reactions is considered in the appendix.

HW-27443

Warren, Curtis

"Graphite Stability under Earthquake Conditions" (3-18-53) 9 p. "6."

Results of analyses show that the graphite stack of the K units can withstand a Zone 2 earthquake with negligible damage, even if considerable distortion has occurred. There is no apparent danger of the reactors going out of control because of the method used to align the top cast iron and the ball 3-X slots. Methods of analysis are given.

HW-28286

Greninger, A. B.

"Recommendations of Reactor Safeguard Committee" (6-4-53) 4 p.

Information and comments on questions asked by the committee (WASH-142) concerning a self-actuating safety device, an instrument capable of measuring low reactivity and indicating criticality, earthquake detection, separate water lines for K reactor, and adequate procedures for handling enriched material.

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Parker, H. M. and J. M. Smith

"Recommendations of Reactor Safeguard Committee" (7-9-53) 9 p.

Answers to questions raised by the RSC concerning K reactors including information on environs radioactivity distribution as a result of disaster. Air, water, land, crop, and human contamination for various incidents are given.

HW-28709

Young, J. R.

"The Feasibility of a Crash Discharge of the Hanford Reactors Following a Disaster at Grand Coulee Dam" (7-14-53) 14 p.

The reactor areas would be flooded as a result of the disaster. The possibilities of a crash discharge under present conditions and with additional continuous discharge apparatus are discussed and it is concluded that crash discharge under present conditions is impossible but with continuous discharge apparatus, all but enriched material, could be discharged. Difficulties in slug disposal following discharge and possible effects on the reactor storage basins with attendant contamination are discussed.

HW-28756

Armstrong, E. L.

"Addendum to 'Summary Report of Reactor Hazards for Twin 100-K Area Reactors,' HW-25892 - October 10, 1952" (7-20-53) 11 p. *in.*

The fact that the graphite temperature coefficient changes from positive to negative during the transition from a wet to dry operating reactor was neglected in the original document. The effects of this change on a runaway initiated by loss of water and failure of all controls are considered in the four cases given.

HW-29387

Parker, H. M.

"Potential Damage from a K-Reactor Incident" (9-18-53) 12 p.

Summary of the liability for damage due to possible reactor disasters is outlined. Suggestions are made for further study on the probability and results of disasters.

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HW-29555

Healy, J. W.

"Single Tube Failures" (10-6-53) 6 p.

Possible radiation hazards as a result of a single tube failure are of two types: (1) release to effluent water, and (2) release to the atmosphere. Estimates of the limiting conditions in each case are made.

HW-29736

Lewis, W. R.

"Trip Report - U. K. - U. S. - Canada Reactor Safety Conference - Chalk River, October 13-14, 1953" (10-23-53) 6 p.

Summary of the information presented concerning liability of reactors to disaster methods of prevention, and consequences. See HW-29865 and HW-29831 for other reports.

HW-29830

Maiden, J. E.

"Crash Discharge of Hanford Reactor-Grand Coulee Disaster" (11-2-53) 1 p.

Letter including a summary of HW-28709 showing a crash discharge to be impossible under present conditions but with continuous discharge apparatus all but enriched material could be discharged.

HW-29831

Healy, J. W.

"Tripartite Conference on Nuclear Reactor Safety" (11-2-53) 9 p.

Notes on methods by which incidents could occur, discussion of incidents which have occurred, prevention of failures, and possible results of major failures. Comparison of tolerance levels in industrial and reactor operations, chemical reaction of molten metals and water, effects of temperature on reactivity, biological effects of reactor incidents, deposition of radioactivity from the atmosphere, and decontamination of NRX building and equipment following incident. See HW-29865 and HW-29736 for further comments.

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HW-29865

Ozeroff, W. J.

"Report on Trip to Chalk River" (11-5-53) 5 p.

Brief summary of some papers presented at the Tripartite Reactor Safeguard Meeting covering the following: history and philosophy of the committee; industrial aspects of safety; suggestion that several sample reactors be exploded to study; some chemical reactions as a result of reactor runaway; control of the NRU reactor; description of one near incident in the GLEEP pile; biological effects of ZPR-incident; and formula for spread of contamination. See HW-29736, HW-29831 for other reports.

HW-29907

Healy, J. W.

"Single Tube Failures" (11-9-53) 5 p.

Calculations of the rate of temperature increase as a result of loss of cooling water to a single tube allow an assumed sequence of events to be made. Amounts of active isotopes and boiling temperatures for a tube operated at 1 megawatt for 100 days are given. Possible release in effluent water and atmosphere is outlined.

HW-30280

Healy, J. W.

"Computations of the Environmental Effects of a Reactor Disaster" (12-14-53) 85 p.

Computations of two cases, (1) sudden release with puff dilution and (2) gradual release over a period of ten hours, are based on Sutton's equations for atmospheric dilutions. Atmospheric diffusion, ground deposition, external dose, lung deposition, rainout, river contamination, biological effects (human, crops, livestock) and property damage are considered.

HW-30689

Anderson, R. K.

"Memorandum on Temperature Increase in Process Tubes after Power Failure for Case 4-A at 100-H and 100-F Plants - Project CG-558" (1-29-54) 2 p.

Note on increase in tube temperatures after power failure if secondary process pumps are replaced with larger pumps. (Case 4-A). It is concluded that there is a sufficient margin of safety in operating under these conditions.

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HW-30748

Fullmer, G. C.

"Review of Safety Control Philosophy" (3-10-54) 11 p.

Bases for specifying nuclear control requirements are reviewed and recommendations are made consistent with the hazard due to residual fission product heating. The control of the wet pile and of a dry pile resulting from loss of cooling water during or in the first few seconds following pile operation and from water loss during outages is discussed. The reactivity effects are approximated. Possible results of a pile runaway are included.

HW-30841

Brown, J. H.

"Review of Hazards with Respect to P-10 Loading" (2-12-54) 13 p.

Increased hazards as a result of tritium loadings are considered with particular emphasis on the loss of cooling water. The pile may go super-critical, in spite of existing controls, with either partial or full tritium loading. Other disasters are considered briefly.

HW-30960

Greager, O. H.

"Review of Hazards - Full Pile P-10 Loading" (2-26-54) 3 p.

The hazards of tritium loading are briefly evaluated with particular attention to loss of cooling water. Complete flooding of the pile in an emergency is considered.

HW-31127

Healy, J. W.

"Single Tube Failures" (3-12-54) 8 p.

A re-examination of the environmental effects due to loss of cooling water from a single tube has been made in view of recent estimates that uranium will melt in one minute and aluminum in five to ten seconds. An assumed sequence of events, the boiling temperatures and composition of fission products involved, and the possible activity of effluent water and atmosphere are given.

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HW-31180

Foley, D. J.

"Assessment of Disaster Control Systems" (4-30-54) 20 p.

Loss of coolant as a result of a breach in Grand Coulee Dam, direct attack on HAPO with various warning periods, and sabotage of air attack with no warning period are discussed as risks. Auxiliary process tube cooling and graphite wetting are assessed for practicality and value as ways of providing auxiliary control and/or cooling.

HW-31387

Foley, D. J.

"Preliminary Assessment of Disaster Control Systems" (3-30-54) 5 p.

The feasibility of using auxiliary process tube cooling and graphite wetting as methods for auxiliary control and/or cooling in the event of loss of cooling water has been roughly assessed for practicality and value. Installation of both systems is recommended.

HW-31515

Greninger, A. B.

"Reactor Safeguards Recommendations" (4-20-54) 3 p.

This document reviews the status of (1) safety fuse development, (2) safety of enriched loading, (3) supplemental cooling by either the introduction of water into the graphite through rear face or top, of pile or supplying basin water to front face cross headers, and (4) sub-critical monitoring. This information was requested by HAN-53894, letter from D. F. Shaw to W. E. Johnson.

HW-31741

Greager, O. H.

"Reactor Safeguards Recommendations" (5-4-54) 8 p.

Hazards of a fully enriched fuel loading of reactors are compared with those of partial loading. Major factors involved are discussed, such as, reactivity and temperature effects under wet and dry pile conditions during normal operation and during an extended outage. Current developments on supplemental cooling, safety fuse development, startup procedures, and other committee suggestions are briefly reviewed.

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