

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
WASHINGTON, D.C. 20555

October 4, 1993

NRC INFORMATION NOTICE 93-77: HUMAN ERRORS THAT RESULT IN INADVERTENT TRANSFERS OF SPECIAL NUCLEAR MATERIAL AT FUEL CYCLE FACILITIES

Addressees

All nuclear fuel cycle licensees.

Purpose

This information notice is to alert addressees to possible sampling program deficiencies that may arise at nuclear fuel cycle facilities because of the human factors component of nuclear criticality sampling programs. It is expected that licensees will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute new U.S. Nuclear Regulatory Commission requirements; therefore, no specific action or written response is required.

Description of Circumstances

In August 1992, a licensee notified the NRC that an operator had emptied the contents of a favorable geometry slab hopper, used to store UO_2 powder on an interim basis, into an unfavorable geometry blender before receiving the sample analysis for the contents of the slab hopper. The sampling of the UO_2 powder in the slab hopper provides one of the controls to ensure that the moisture content of the powder is below 1 wt(%) H_2O . This restriction on the water content in the UO_2 powder is necessary to ensure nuclear criticality safety in the unfavorable geometry blender.

The licensee conducted an evaluation to determine the cause(s) of the inadvertent transfer of UO_2 powder from the slab hopper to the blender. This evaluation revealed that the inadvertent transfer occurred as follows:

- (1) An operator erroneously assumed that a completed powder release form lying on a desk common to all slab hoppers was for a slab hopper whose sample results had not yet been received.
- (2) The operator then retrieved a key from the control room and subsequently released the contents (750 kg of UO_2 powder) of the slab hopper into the unfavorable geometry blender. (This key was supposed to be controlled by the shift supervisor, as stipulated by procedure.)

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- (3) The operator informed the supervisor that he had dumped the contents of the slab hopper into the blender. The shift supervisor subsequently recorded this information in the shift log. (At this time, the shift supervisor should have realized that this was an unauthorized transfer because he had not signed the powder release form for the slab hopper, as required by procedure.)

The inadvertent transfer was later discovered when the next shift operator found an unsigned powder release form (lying on the common desk in the operating room) for the slab hopper whose powder had been released. The operator did note, from the form, that the laboratory results for the slab hopper were within the release limits. The operator informed the supervisor, who subsequently verified that the results were within the prescribed moisture limits. The supervisor then completed and signed the powder sampling record form. NRC was informed of the event in accordance with NRC Bulletin 91-01.

Discussion

The inadvertent transfer of special nuclear material, in the previously described event, resulted from deficiencies associated with the human factors component of the licensee's sampling program. In this instance, the sampling program was deficient in two respects. Using a common desk for all powder line paper work represented a less than favorable method to store completed powder release forms. This led to a situation in which an operator could easily mistake one powder release form for another. To prevent this problem from reoccurring, the licensee uses a separate desk to house the forms for each powder line. (This action has made the inadvertent reading of the wrong powder release form unlikely.) The licensee's sampling program was also deficient with respect to securing control of the keys, which are used to release the powder from the slab hoppers to the blender. By not having a supervisor control the keys, the licensee created a situation where an operator's single mistake could lead to an inadvertent transfer. The licensee's corrective action is to require that the supervisor control the release keys for the slab hoppers. The licensee's corrective actions are sufficient to ensure that the following two independent and unlikely events are necessary before a criticality is possible:

1. The operator mistakenly reads the wrong powder release form.
2. The supervisor misreads the form and subsequently gives the operator the key to release the powder from the slab hopper.

It should be noted, however, that another possible path to a nuclear criticality could involve a contingency in which an operator is given a common key by the supervisor. In this scenario, the operator could mistakenly use the common key to release special nuclear material from the wrong slab hopper. To preclude this event, the licensee utilizes individual keys for each slab hopper.

In addition to the previously described event, there have been other occasions in which a deficient nuclear criticality sampling program has led to an inadvertent transfer of special nuclear material. One such case occurred when a licensee operator analyzed two samples from one tank, but recorded them as being from another tank. As a result, an inadvertent transfer occurred. Another type of event occurred, on two separate occasions, in which a licensee reported the inadvertent transfer of liquid-bearing uranium to an unfavorable geometry container. These transfers occurred when an operator mistakenly entered the analyses for a different tank into the computer.

The previously discussed events illustrate the necessity for licensees to carefully review their nuclear criticality sampling programs. Licensees should vigilantly review their respective programs to ensure that the double contingency principle is fulfilled. This principle requires that at least two independent and unlikely concurrent process changes occur before a criticality is possible. For nuclear criticality sampling programs, this requires the following:

1. Assurance that an operator mistake (contingency) at any juncture cannot lead to an inadvertent transfer. That is, a second contingency is necessary before a nuclear criticality event is possible.
2. A contingency must be an unlikely event. This may require one of the following controls: using color-coded forms, segregating forms, using different keys, requiring multiple individuals to inspect results, etc.

This information notice requires no specific action or written response. If you have questions about the information in this notice, please contact the technical contact listed below or the appropriate regional office.



Robert F. Burnett, Director
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Technical contact: Marc Klasky, NMSS
(301) 504-2504

Attachments:

1. List of Recently Issued NMSS Information Notices
2. List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NMSS INFORMATION NOTICES

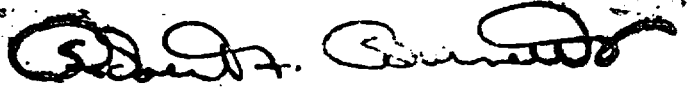
Information Notice No.	Subject	Date of Issuance	Issued to
93-69	Radiography Events at Operating Power Reactors	09/02/93	All holders of OLs or CPs for nuclear power reactors and all radiography licensees.
93-60	Reporting Fuel Cycle and Materials Events to the NRC Operations Center	08/04/93	All fuel cycle and materials licensees.
93-50	Extended Storage of Sealed Sources	07/08/93	All licensees authorized to possess sealed sources.
93-36	Notifications, Reports, and Records of Misadministrations	05/07/93	All U.S. Nuclear Regulatory Commission medical licensees.
93-31	Training of Nurses Responsible for the Care of Patients with Brachytherapy Implants	04/13/93	All U.S. Nuclear Regulatory Commission medical licensees.
93-30	NRC Requirements for Evaluation of Wipe Test Results; Calibration of Count Rate Survey Instruments	04/12/93	All U.S. Nuclear Regulatory Commission medical licensees.
93-19	Slab Hopper Bulging	03/17/93	All nuclear fuel cycle licensees.
93-18	Portable Moisture-Density Gauge User Responsibilities during Field Operations	03/10/93	All U.S. Nuclear Regulatory Commission licensees that possess moisture-density gauges.
93-14	Clarification of 10 CFR 40.22, Small Quantities of Source Material	02/18/93	All Licensees who possess source material.

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-76	Inadequate Control of Paint and Cleaners for Safety-Related Equipment	09/21/93	All holders of OLs or CPs for nuclear power reactors.
93-75	Spurious Tripping of Low-Voltage Power Circuit Breakers with GE RMS-9 Digital Trip Units	09/17/93	All holders of OLs or CPs for nuclear power reactors.
93-74	High Temperatures Reduce Limitorque AC Motor Operator Torque	09/16/93	All holders of OLs or CPs for nuclear power reactors.
93-73	Criminal Prosecution of Nuclear Suppliers for Wrongdoing	09/15/93	All NRC licensees.
93-72	Observations from Recent Shutdown Risk and Outage Management Pilot Team Inspections	09/14/93	All holders of OLs or CPs for nuclear power reactors.
93-71	Fire at Chernobyl Unit 2	09/13/93	All holders of OLs or CPs for nuclear power reactors.
93-70	Degradation of Boraflex Neutron Absorber Coupons	09/10/93	All holders of OLs or CPs for nuclear power reactors.
93-69	Radiography Events at Operating Power Reactors	09/02/93	All holders of OLs or CPs for nuclear power reactors and all radiography licensees.
93-68	Failure of Pump Shaft Coupling Caused by Temper Embrittlement during Manufacture	09/01/93	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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1. List of Recently Issued NMSS Information Notices
2. List of Recently Issued NRC Information Notices

*See previous concurrence

OFC	FCLB*		FCLB*	E	FCLB*	E	FCLB*	E
NAME	MKlasky		VTharpe		MTokar		RPierson	
DATE	8/05/93		8/05/93		8/10/93		8/10/93	
OFC	FCOB*		DD:FCSS		FCSS	N		
NAME	MSmith		RBurnett		E. Ten Eyck			
DATE	9/14/93		09/22/93		10/1/93			

DOC NAME: 93-77.IN

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*Im6B
 KRamsey xmr
 9/21/93*

*See previous concurrence [G:\Sampling]

OFC	FCLB*		FCLB*	E	FCLB*	E	FCLB*	E
NAME	MKlasky		VTharpe		MTokar		RPierson	
DATE	8/05/93		8/05/93		8/10/93		8/10/93	
OFC	FCOB	K	DD:FCSS		D:FCSS			
NAME	MSmith		ETenEyck AL		RBurnett			
DATE	9/14/93		9/ /93		9/30/93			

In addition to the previously described event, there have been other occasions in which a deficient nuclear criticality sampling program has led to an inadvertent transfer of special nuclear material. One such case occurred when a licensee operator analyzed two samples from one tank, but recorded them as being from another tank. As a result, an inadvertent transfer occurred. Another type of event occurred, on two separate occasions, in which a licensee reported the inadvertent transfer of liquid-bearing uranium to an unfavorable geometry container. These transfers occurred when an operator mistakenly entered the analyses for a different tank into the computer.

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NAME	M Klasky		V Tharpe		M Tokar		R Pierson	
DATE	8/05/93		8/05/93		8/10/93		8/10/93	
OFC	DO:FCSS		D:FCSS		FCOB			
NAME	J Greeves		R Burnett		m. SMITH			
DATE	8/ /93		8/ /93					

C = COVER

E = COVER & ENCLOSURE
 [G:\Sampling]

N= NO COPY

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NAME	MK Klasky		V Charpe		MTokar		RPierson
DATE	8/5 /93		8/5 /93		8/ /93		8/ /93
OFC	DD:FCSS		D:FCSS				
NAME	JGreeves		RBurnett				
DATE	8/ /93		8/ /93				

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[G:\Sampling]

MATERIAL LICENSE PROGRAM CODES

SEPTEMBER 1993

PROGRAM CODE	TITLE
01100	ACADEMIC TYPE A BROAD
01110	ACADEMIC TYPE B BROAD
01120	ACADEMIC TYPE C BROAD
01200	ACADEMIC OTHER (SECONDARY CODE)
02110	MEDICAL INSTITUTION BROAD
02120	MEDICAL INSTITUTION LIMITED
02121	MEDICAL INSTITUTION CUSTOM
02200	MEDICAL PRIVATE PRACTICE - LIMITED
02201	MEDICAL PRIVATE PRACTICE - CUSTOM
02209	GRANDFATHERED IN-VIVO GENERAL MEDICAL USE
02210	EYE APPLICATORS STRONTIUM-90
02220	MOBILE NUCLEAR MEDICINE SERVICE
02230	HIGH DOSE RATE REMOTE AFTERLOADER
02231	MOBILE HIGH DOSE RATE REMOTE AFTERLOADER
02300	TELE THERAPY
02400	VETERINARY NON-HUMAN
02410	IN-VITRO TESTING LABORATORIES
02500	NUCLEAR PHARMACIES
02511	MEDICAL PRODUCT DISTRIBUTION - 32.72 - PREPARED RADIOPHARMACEUTICALS
02512	MEDICAL PRODUCT DISTRIBUTION - 32.73 - GENERATORS AND KITS
02513	MEDICAL PRODUCT DISTRIBUTION - 32.74 - SOURCES AND DEVICES
03110	WELL LOGGING BYPRODUCT AND/OR SNM TRACER AND SEALED SOURCES
03111	WELL LOGGING BYPRODUCT AND/OR SNM SEALED SOURCES ONLY
03112	WELL LOGGING BYPRODUCT ONLY-TRACERS ONLY
03113	FIELD FLOODING STUDIES
03120	MEASURING SYSTEMS FIXED GAUGES
03121	MEASURING SYSTEMS PORTABLE GAUGES
03122	MEASURING SYSTEMS ANALYTICAL INSTRUMENTS
03123	MEASURING SYSTEMS GAS CHROMATOGRAPHS
03124	MEASURING SYSTEMS OTHER
03211	MANUFACTURING AND DISTRIBUTION TYPE A BROAD
03212	MANUFACTURING AND DISTRIBUTION TYPE B BROAD
03213	MANUFACTURING AND DISTRIBUTION TYPE C BROAD
03214	MANUFACTURING AND DISTRIBUTION OTHER
03218	NUCLEAR LAUNDRY
03219	DECONTAMINATION SERVICES
03220	LEAK TEST SERVICE ONLY
03221	INSTRUMENT CALIBRATION SERVICE ONLY - SOURCE LESS THAN 100 CURIES
03222	INSTRUMENT CALIBRATION SERVICE ONLY - SOURCE GREATER THAN 100 CURIES
03223	LEAK TEST & INSTR CALIBRATION SERVICE - SOURCE LESS THAN 100 CURIES
03224	LEAK TEST & INSTR CALIBRATION SERVICE - SOURCE GREATER THAN 100 CURIES
03225	OTHER SERVICES
03231	WASTE DISPOSAL (BURIAL)
03232	WASTE DISPOSAL SERVICE PREPACKAGED ONLY
03233	WASTE DISPOSAL SERVICE INCINERATION
03234	WASTE DISPOSAL SERVICE PROCESSING AND/OR REPACKAGING
03235	INCINERATION - NONCOMMERCIAL (SECONDARY CODE)
03240	GENERAL LICENSE DISTRIBUTION - 32.51
03241	GENERAL LICENSE DISTRIBUTION - 32.53

MATERIAL LICENSE PROGRAM CODES

SEPTEMBER 1993

PROGRAM CODE	TITLE
03242	GENERAL LICENSE DISTRIBUTION - 32.57
03243	GENERAL LICENSE DISTRIBUTION - 32.61
03244	GENERAL LICENSE DISTRIBUTION - 32.71
03250	EXEMPT DISTRIBUTION - 32.11 - EXEMPT CONCENTRATIONS AND ITEMS
03251	EXEMPT DISTRIBUTION - 32.14 - CERTAIN ITEMS
03252	EXEMPT DISTRIBUTION - 32.17 - RESINS
03253	EXEMPT DISTRIBUTION - 32.18 - SMALL QUANTITIES
03254	EXEMPT DISTRIBUTION - 32.22 - SELF LUMINOUS PRODUCTS
03255	EXEMPT DISTRIBUTION - 32.26 - SMOKE DETECTORS
03310	INDUSTRIAL RADIOGRAPHY FIXED LOCATION
03320	INDUSTRIAL RADIOGRAPHY TEMPORARY JOB SITES
03510	IRRADIATORS SELF SHIELDED LESS THAN 10000 CURIES
03511	IRRADIATORS OTHER LESS THAN 10000 CURIES
03520	IRRADIATORS SELF SHIELDED GREATER THAN 10000 CURIES
03521	IRRADIATORS OTHER GREATER THAN 10000 CURIES
03610	RESEARCH AND DEVELOPMENT TYPE A BROAD
03611	RESEARCH AND DEVELOPMENT TYPE B BROAD
03612	RESEARCH AND DEVELOPMENT TYPE C BROAD
03613	R & D BROAD - MULTISITE-MULTIREGIONAL
03620	RESEARCH AND DEVELOPMENT OTHER
03710	CIVIL DEFENSE
03800	BYPRODUCT MATERIAL POSSESSION ONLY
03900	DECOMMISSIONING OF BYPRODUCT MATERIAL FACILITIES
06100	LOW-LEVEL WASTE STORAGE AT REACTOR SITES
06101	LOW-LEVEL WASTE STORAGE - OTHER (SECONDARY CODE)
11100	MILLS
11200	SOURCE MATERIAL OTHER LESS THAN 150 KILOGRAMS
11210	SOURCE MATERIAL SHIELDING
11220	SOURCE MATERIAL MILITARY MUNITION - INDOOR TESTING
11221	SOURCE MATERIAL MILITARY MUNITION - OUTDOOR TESTING
11230	SOURCE MATERIAL GENERAL LICENSE DISTRIBUTION - 40.34
11300	SOURCE MATERIAL OTHER GREATER THAN 150 KILOGRAMS
11400	URANIUM HEXAFLUORIDE (UF6) PRODUCTION PLANTS
11500	SOLUTION MINING (R & D AND COMMERCIAL FACILITIES)
11600	HEAP LEACH, ORE BUYING STATIONS AND BYPRODUCT RECOVERY
11700	RARE EARTH EXTRACTION AND PROCESSING
11800	SOURCE MATERIAL POSSESSION ONLY
11900	DECOMMISSIONING OF SOURCE MATERIAL FACILITIES
21130	HOT CELL OPERATIONS
21135	DECOMMISSIONING OF ADVANCED FUEL R&D AND PILOT PLANTS
21200	URANIUM ENRICHMENT PLANTS
21210	URANIUM FUEL FABRICATION PLANTS
21215	DECOMMISSIONING OF URANIUM FUEL FABRICATION PLANTS
21240	URANIUM FUEL R&D AND PILOT PLANTS
21310	CRITICAL MASS MATERIAL - UNIVERSITIES
21320	CRITICAL MASS MATERIAL - OTHER THAN UNIVERSITIES
21325	DECOMMISSIONING OF CRITICAL MASS - OTHER THAN FUEL FABRICATION
22110	SNM PLUTONIUM - UNSEALED LESS THAN A CRITICAL MASS
22111	SNM U-235 AND/OR U-233 UNSEALED LESS THAN A CRITICAL MASS
22120	SNM PLUTONIUM - NEUTRON SOURCES LESS THAN 200 GRAMS
22130	POWER SOURCES WITH BYPRODUCT AND/OR SPECIAL NUCLEAR MATERIAL
22140	SNM PLUTONIUM - SEALED SOURCES IN DEVICES
22150	SNM PLUTONIUM - SEALED SOURCES LESS THAN A CRITICAL MASS
22151	SNM U-235 AND/OR U-233 SEALED SOURCES LESS THAN A CRITICAL MASS
22160	PACEMAKER BYPRODUCT AND/OR SNM - MEDICAL INSTITUTION
22161	PACEMAKER BYPRODUCT AND/OR SNM - INDIVIDUAL
22162	PACEMAKER BYPRODUCT AND/OR SNM - MANUFACTURING AND DISTRIBUTION
22170	SNM GENERAL LICENSE DISTRIBUTION (70.39)
22200	DECOMMISSIONING OF OTHER SNM FACILITIES - LESS THAN CRITICAL MASS
23100	FRESH FUEL STORAGE AT REACTOR SITES
23200	INTERIM SPENT FUEL STORAGE
23300	SNM POSSESSION ONLY - OTHER THAN REACTOR FUEL
25110	TRANSPORT-PRIVATE CARRIAGE

GENERIC COMMUNICATIONS INDEX INPUT FORM

GENERAL SYSTEM OR TOPIC (Pick a Maximum of 2)	SPECIFIC COMPONENT (Pick a Maximum of 2)
Administrative <u>Analysis</u> Auxiliary Feedwater Chemistry Containment Cooling Water Decay Heat Removal ECCS Electric Power Emergency Prep Equipment Qualification Feedwater Fire Protection Foundations HVAC Instrumentation and Control Multiple <u>Operations</u> Other Pneumatic Power Conversion Quality Assurance <u>Rad Prot-Non Reactor</u> Rad Prot-Reactor Radwaste Reactivity Control Reactor Reactor Coolant Reactor Trip Reg Guidance Reg Policy Security Structures, Containment Structures, Other Transportation Upgrading Commercial Parts	Actuators, Air Actuators, Motor Actuators, Other Actuators, Solenoid Bolting Circuit Breakers Concrete/Masonry Control Rods and Drives Control Room Operators Diesel Engines Electrical Generators Electrical, Other Fuel and Assemblies Mechanical, Other Multiple <u>Other</u> * Piping Pumps Rad Monitoring Rad Protective Equipment Rad Regs and Program Reactor Internals Relays Sealed Sources Snubbers, Hydraulic Snubbers, Mechanical Soil/Rock Steam Generators Steel/Tendons Structural, Other Supports, Other Switches Testing Transport Packages Turbines Valves, Check Valves, Main Steam Iso Valves, Other Valves, Relief Welds Wiring and Cable

(for MULTIPLE or OTHER, add a footnote for entry into the remarks section)

* Human factors problem

GENERIC COMMUNICATIONS INDEX INPUT FORM - continued

CAUSE OR DEFECT
(Pick a Maximum of 2)

Aging
Analysis
Construction
Corrosion or Cracking
Design
Documentation
Equipment Failure
Installation
Maintenance
Manufacturing
Misconduct or Fraud
Multiple
~~Other~~
Personnel Error
Procedural
Procurement
Training

POTENTIAL EFFECT
(Pick a Maximum of 2)

Cause Accident
Common Mode Failure
Damaged Equipment
Degraded Safety System
Inoperable Safety Function
Multiple
Noncompliance
Other *
Outage
Personnel Hazard
Rad Exp-Occupational
Rad Exp-Public
Rad Release

(for MULTIPLE or OTHER, add a footnote for entry into the remarks section)

* Accidental criticality

GENERIC COMMUNICATIONS INDEX INPUT FORM - continued

VENDORS

(Pick a maximum of 3)

- A -

ABB Brown Boveri
 ACF Industries
 AECL
 AKO, Inc
 ANBEX
 ASCO
 AVCO
 Acurex Aerotherm
 Adams and Westlake
 Advanced Nuc Fuel
 Agastat
 All NSSS Vendors
 All PWR NSSS Vendors
 Allied Signal
 Allis Chalmers
 Alloy & Carbon Steel
 Alloy Steel Products
 Alpha Associates
 Amer. Atomics Corp.
 Amer. Tank & Fabrica
 Amerace Corp
 American Air Filter
 Amersham
 Amp
 Anaconda
 Anchor Darling
 Anderson Greenwood
 Anker-Holth
 Anti-Theft Systems
 Assoc Piping & Engr
 Atomic Energy of Can
 Atwood & Morrill
 Auburn Steel Company
 Automatic Sprinkler
 Automatic Switch Co.
 Automatic Valve Corp
 Automation Ind.

- B -

B&B Promatec
 BBC Brown Boveri
 BIF/General Signal

E

Babcock & Wilcox
 Bahnson Co.
 Barton
 Beau Products
 Bechtel
 Beloit Power Systems
 Bendix
 Bergen-Paterson
 Bethlehem Stl. Corp.
 Bettis
 Bicron Corp
 Bingham-Willamette
 Biomarine Corp.
 Biomarine Industries
 Bisco Products
 Boeing Company
 Borg-Warner
 Brown Boveri
 Bunker Ramo
 Bussman
 Byron Jackson

- C -

C&D
 C&D Power Systems
 C.P.Clare
 CMA
 CMA International
 California Breakers
 Calvert Co.
 Capitol Pipe & Steel
 Carter-Wallace
 Chem-Nuclear Corp
 Chicago Bridge & Irrn
 Chris-Craft
 Circuit Brkr Systems
 Cogenerl (France)
 Colt Industries
 Combustion Engrg.
 Comsip
 Con-Chem, Inc.
 Conax
 Consolidated Pipe
 Control Components

Control Valves Spec.
 Cooper Industries
 Cooper-Bessemer
 Copes-Vulcan
 Copperweld Steel
 Cor-Val
 Coratomic, Inc.
 Cornell-Duebiller
 Corner & Lada, Inc.
 Crane
 Crosby Valve
 Cummins
 Cutler-Hammer

- D -

D.G. O'Brien Co.
 DIS/ADLPIPE, Inc.
 Darling
 Delta Southern
 Descote
 Detroit Diesel Al'sn
 Dow Chemical Corp
 Dravo Corp
 Dresser-Consolidated
 DuPont
 Duer Spring
 Durametallic

- E -

E-Systems, Inc.
 EG&G
 EGS Corp
 ELMA Engineering
 Ebasco
 Eberline Instrument
 Electrical Products
 Electro Devices
 Electro Motive, GMC
 Exide

- F -

Fairbanks Morse

GENERIC COMMUNICATIONS INDEX INPUT FORM - continued

VENDORS

(Pick a maximum of 3)

Familian Northwest
Fisher Controls Co.
Fletcher Suit
Foxboro
Furmanite

- G -

G. H. Bettis Co.
GE
GNB Batteries, Inc.
GPE
GTE Sylvania
Gamma Industries
Gamma Pipeliner
Geiger-Muller
General Motors
Golden Gate Forge
Gould, Inc.
Gould-Brown Boveri
Gould-Showmut
Greer Hydraulics

- H -

Hammell-Dahl
Hardware Specialty
Hayward Tyler Pump
Henry Pratt Company
Hexcel/MCI
Heyer-Scholte
Hilti
Hollinsworth
Honeywell
Huico
Hydro-Line Mfg Co

- I -

ITE
ITE/Siemens-Allis
ITT Barton
ITT Cannon
ITT General Controls
ITT Grinnell

E

Impala Electronics
Indstr Control Supp
Indstrl Process Engr
Industrial Nuclear
Ingersoll-Rand
Inryco
Interstate Stl.Sply.
Intl Nuclear Safegd

- J -

J.T.Baker Chemical
Joseph Oat

- K -

Kay-Ray, Inc.
Kerotest
Kerr-McGee
Kinometrics
Korean Ind Testing
Kulka

- L -

LND Inc.
Liberty Equipment
Limitorque
Littlefuse
Lixi, Inc.
Loctite Corp.
Louis Allis
Luxfer USA Ltd.

- M -

MN Mining & Mfg (3M)
MQS Inspection
Magnaflux
Malcolm Foundry
Marathon
Marvin Engineering
Masonellan-Dresser
McDonnell-Millen Co.
Meredith PVN

Midwest Valve & Supp
Mine Safety Appli.
Mission Mfg. Co.
Mitsubishi
Mobil Oil
Mock Mfg
Morrison-Knudson
Motorola
Multiple

- N -

NAMCO Controls
Nomex-Kapton
Nordberg
Nortec Corp
Noryl
Nuclear Containers
Nuclear Data, Inc.

- O -

Okonite Co.
Other *
Owens-Corning

- P -

PAL
Pacific Pump
Pacific Resistor
Pacific Scientific
Pacific Valves, Inc.
Page Company
Panalarm
Panasonic
Parker-Hannifin
Parkwell Labs.
Paul Munroe Hyd
Peerless Pump
Peerless-Winsmith
Phoell Manufacturing
Phoenix Steel Corp.
Picker/AMS
Piping Supplies

GENERIC COMMUNICATIONS INDEX INPUT FORM - continued

VENDORS

(Pick a maximum of 3)

Pittsburg Testing Lb
Planned Maint Sys
Potter & Brumfield
Power Inspection Inc
Powerplant Spec
Pratt Company
Presray
Pressure Vessel Nuc
Pullman Higgins

- Q -

- R -

R. A. Hiller Company
Radiation Technology
Radionics, Inc.
Ray Miller, Inc.
Raychem
Reliance Electric
Rexnord
Riley-Beard, Inc.
Robertshaw Controls
Rockbestos Co.
Rockwell
Rockwell-Intl.
Rockwell-Edward
Rosemount
Rotork
Ruskin Mfg

- S -

S. T. Semicon-
SOR, Inc.
SPEC-2T
Sargent & Greenleaf
Satin American
Schutte & Koerting
Scott
Scott Aviation
Service Supply
Shelwell Services
So Cal Valve Maint.
Sodeco

Solidstate Controls
Source Prod & Equip
Southwestern Engr
Spectronics
States
States Company
Static O-Ring
Stokley Enterprises
Stone & Webster
Sun Shipyard Corp
Superior Valve
SurvivAir
Swagelok
Systems Control

- T -

TRC
Target Rock
Terry Turbine
Thomas & Betts
Topaz
Torrington Co.
Transamerica DeLaval
Tube Turns
Tube-Line Corp

- U -

U. S. Steel
UE&C
Union Pump
Unistrut Corp

- V -

V.W.R. Scientific
Valcor Engineering
Velan Engineering
Velan Valve Corp
Viking Corporation
Vogt Machine Co.

- W -

W-K-M Division
W.H. Stewart
Walworth Company
West Jersey Mfg
Western Piping
Westinghouse
William Powell Co.
Wisc. Prot. Coatings
Woodward Governor
Wyle Labs

- X -

- Y -

YOH Security
Yarway
Young Radiator
Youngstown Welding

- Z -

Zenith Supply Co.

(for MULTIPLE or OTHER, add a footnote for entry into the remarks section)

E * Not applicable to a vendor