

Salt

By Robert T. MacMillan ¹

Production of salt in 1972 declined slightly for the second consecutive year following a 12-year period of steady growth. The quantity actually sold or used by producers, however, increased 2% compared with the 1971 figures. This increase was attributed to a large inventory of unused rock salt carried over from the previous year. The average value of salt sold or used in 1972 declined 4% compared with the 1971 value.

Exports increased 30% in quantity and 33% in value compared with correspond-

ing 1971 figures. Imports, however, declined 10% in quantity and 17% in value.

Legislation and Government Programs.

—Tightened antipollution standards set by Federal and State environmental pollution control agencies resulted in the final closing of Olin Corp.'s chlorine-caustic soda plant, Virginia's lone salt producing company. The cost of modernizing the plant to meet more stringent effluent standards was considered too high, and production was phased out early in 1972.

Table 1.—Salient salt statistics
(Thousand short tons and thousand dollars)

	1968	1969	1970	1971	1972
United States:					
Production-----	NA	NA	1 46,764	1 44,700	1 44,010
Sold or used by producers-----	41,274	44,245	1 45,896	1 44,077	1 45,022
Value-----	272,275	287,680	304,759	303,687	296,772
Exports-----	729	716	423	670	869
Value-----	4,650	4,486	3,657	4,182	5,544
Imports for consumption-----	3,456	3,302	3,536	3,855	3,463
Value-----	11,487	11,990	13,329	14,429	11,979
Consumption, apparent-----	44,002	46,831	49,009	47,262	47,616
World: Production-----	138,426	150,495	161,081	158,931	162,560

NA Not available.

¹ Excluding Puerto Rico; 32,000 short tons (1970), 23,500 short tons (1971) and 29,000 short tons (1972).

DOMESTIC PRODUCTION

Seventeen States recorded salt production in 1972. The two leading States, Louisiana and Texas, produced 52% of the total output. Ohio, New York, and Michigan contributed 36%. Salt was produced by 54 companies at 96 plants in the United States and Puerto Rico in 1972. Eleven companies, each producing more than 1 million tons in 1972, operated 42 plants and accounted for 85% of the total salt output. Eighteen companies with a production of less than 1 million tons but more than 100,000 tons operated 28 plants and accounted for 14% of the total production. Twenty-five other companies whose indi-

vidual production was less than 100,000 tons operated 26 plants and supplied the remaining 1% of the total salt output.

Fifteen plants, each with a production of over 1 million tons, accounted for 64% of the total salt output. Ten plants, each producing between 500,000 and 1 million tons, accounted for 14% of the total. The remaining 22% was supplied by 71 plants.

A trend toward consolidation in the salt industry continued with Solar Salt Co. of Utah being sold to American Salt Corp. Dakota Salt Co. of North Dakota was ac-

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Table 2.—Salt sold or used by producers in the United States, by method of recovery
(Thousand short tons and thousand dollars)

Recovery method	1971		1972	
	Quantity	Value	Quantity	Value
Evaporated:				
Bulk:				
Open pans or grainers.....	385	8,745	388	13,225
Vacuum pans.....	3,289	86,478	3,287	85,081
Solar.....	1,937	21,432	1,799	15,115
Solar.....	367	10,532	376	10,927
Pressed blocks.....				
Total ¹	5,928	127,186	5,850	124,348
Rock:				
Bulk.....	13,613	87,226	14,369	88,903
Pressed blocks.....	87	2,095	66	2,138
Total ¹	13,700	89,321	14,434	91,041
Salt in brine (sold or used as such).....	24,449	87,180	24,737	81,333
Grand total ¹	44,077	303,687	45,022	296,772

¹ Data may not add to totals shown because of independent rounding.

Table 3.—Salt sold or used by producers in the United States
(Thousand short tons and thousand dollars)

State	1971		1972	
	Quantity	Value	Quantity	Value
California.....	1,887	21,142	1,621	14,860
Kansas ¹	1,240	18,712	1,369	20,562
Louisiana.....	13,352	67,950	13,514	67,464
Michigan.....	4,458	49,007	4,358	50,761
Michigan.....	146	1,130	W	W
New Mexico.....	5,303	43,601	5,604	43,866
New York.....	5,709	46,651	6,147	47,710
Ohio.....	9,217	40,838	9,744	36,544
Texas.....	614	5,213	660	4,955
Utah.....	1,174	4,778	1,232	5,963
West Virginia.....	976	4,667	771	4,087
Other States ²				
Total ³	44,077	303,687	45,022	296,772
Puerto Rico.....	29	570	29	580

W Withheld to avoid disclosing individual company confidential data; included with "Other States."

¹ Quantity and value of brine included with "Other States."

² Includes Alabama, Colorado, Hawaii, Kansas (brine only), Nevada, North Dakota, Oklahoma, Virginia, and States indicated by symbol W.

³ Data may not add to totals shown because of independent rounding.

Table 4.—Evaporated salt sold or used by producers in the United States
(Thousand short tons and thousand dollars)

State	1971		1972	
	Quantity	Value	Quantity	Value
California.....	1,592	20,164	1,355	13,980
Kansas.....	676	15,847	723	17,207
Louisiana.....	275	9,399	269	8,840
Louisiana.....	1,174	30,042	1,169	32,562
Michigan.....	658	19,842	600	18,015
New York.....	763	21,072	806	22,174
Ohio.....	790	10,819	930	11,571
Other States ¹				
Total ²	5,928	127,186	5,850	124,348
Puerto Rico.....	29	570	29	580

¹ Includes Hawaii, Nevada, New Mexico, North Dakota, Oklahoma, Texas, and Utah.

² Data may not add to totals shown because of independent rounding.

quired by Hardy Salt Co. of Michigan, and Diamond Crystal Salt Co. of Michigan was sold to Oglebay Norton Co. Olin Corp. closed down its salt well facilities at Saltville, Va., after many years of chlorine and caustic soda production. The soda ash plant was closed in 1971. Cargill, Inc. closed its Pawnee Salt Co. in Kansas and its equipment was transferred to Cargill's Gordy plant at Baldwin, La.

Table 5.—Rock salt sold by producers in the United States

(Thousand short tons and thousand dollars)

Year	Quantity	Value
1968.....	12,461	79,867
1969.....	13,397	86,452
1970.....	14,170	95,291
1971.....	13,700	89,321
1972.....	14,434	91,041

Table 6.—Pressed-salt blocks sold by original producers of salt in the United States

(Thousand short tons and thousand dollars)

Year	From evaporated salt		From rock salt		Total ¹	
	Quantity	Value	Quantity	Value	Quantity	Value
1968.....	357	9,246	85	2,321	442	11,567
1969.....	369	9,622	83	2,352	452	11,974
1970.....	368	10,085	79	2,269	447	12,353
1971.....	367	10,532	87	2,095	454	12,627
1972.....	376	10,927	66	2,138	442	13,065

¹ Data may not add to totals shown because of independent rounding.

CONSUMPTION AND USES

Of the total salt consumed in 1972, 54% was consumed as brine, 33% as rock salt, and 13% as evaporated salt. The production of chlorine required 45% of the total salt output, soda ash manufacturing required 13%, and all other chemicals re-

Table 7.—Salt sold or used by producers in the United States, by class and consumer or use

(Thousand short tons)

Consumer or use	1971				1972			
	Evaporated	Rock	Brine	Total ¹	Evaporated	Rock	Brine	Total ¹
Chlorine.....	282	2,733	16,605	19,621	302	2,706	17,718	20,726
Soda ash.....	1	(²)	6,357	6,358	W	W	5,786	5,791
Soap (including detergents).....	24	W	W	27	22	5	(²)	27
All other chemicals.....	426	346	487	1,259	440	479	117	1,036
Textile and dyeing.....	118	75	--	193	132	75	--	207
Meatpackers, tanners, casing manufacturers.....	283	370	--	653	266	353	--	619
Fishing.....	33	4	--	37	42	4	--	45
Dairy.....	55	6	--	61	56	24	--	80
Canning.....	185	55	(²)	241	160	68	(²)	228
Baking.....	110	6	--	116	110	7	--	117
Flour processors (including cereal).....	68	11	(²)	79	70	12	(²)	83
Other food processing.....	475	40	(²)	515	483	37	(²)	520
Ice manufacturers and cold storage companies.....	1	2	--	4	1	2	--	3
Feed dealers.....	362	493	--	1,355	933	453	(²)	1,386
Feed mixers.....	329	258	--	586	354	223	--	577
Metals.....	47	135	(²)	182	W	175	W	227
Ceramics (including glass).....	4	4	--	8	4	3	--	7
Rubber.....	74	W	W	172	36	W	W	173
Oil.....	54	60	51	164	47	62	93	202
Paper and pulp.....	105	115	59	279	W	125	W	201
Water softener manufacturers and service companies.....	413	W	W	680	350	W	W	698
Grocery stores.....	795	441	--	1,236	802	456	(²)	1,258
Railroads.....	1	2	--	3	1	4	--	6
Bus and transit companies.....	1	3	--	3	1	4	--	6
Highway use.....	331	7,571	4	7,905	464	8,787	4	9,255
U.S. Government.....	24	34	(²)	59	26	65	(²)	91
Miscellaneous ³	1,074	620	792	2,487	705	555	809	2,069
Total¹.....	4,618	13,640	24,463	44,283	5,926	15,044	24,664	45,634

W Withheld to avoid disclosing individual company confidential data; included with "Total."

¹ Data may not add to totals shown because of independent rounding.

² Less than 1/2 unit.

³ Includes some exports and consumption in overseas areas administered by the United States.

⁴ Differs from totals shown in tables 2, 4, and 5 because of changes in inventory.

⁵ Differs from totals shown in tables 1, 2, and 3 because of changes in inventory.

Table 8.—Distribution (shipments) of evaporated and rock salt in the United States, by destination
(Thousand short tons)

Destination	1971		1972	
	Evaporated	Rock	Evaporated	Rock
Alabama	52	329	50	407
Alaska	W	W	W	--
Arizona	28	W	36	1
Arkansas	20	89	21	97
California	1,193	82	915	146
Colorado	106	51	113	46
Connecticut	19	129	17	W
Delaware	7	196	6	W
District of Columbia	5	31	4	W
Florida	41	135	41	124
Georgia	62	243	61	263
Hawaii	4	--	W	--
Idaho	51	W	57	1
Illinois	341	370	353	1,304
Indiana	154	416	159	555
Iowa	196	307	200	340
Kansas	80	222	89	189
Kentucky	47	516	48	517
Louisiana	52	380	52	449
Maine	10	172	9	W
Maryland	47	74	44	W
Massachusetts	46	481	77	W
Michigan	190	463	204	W
Minnesota	151	371	150	307
Mississippi	21	102	19	114
Missouri	99	294	111	356
Montana	51	1	58	1
Nebraska	106	83	119	93
Nevada	33	211	31	W
New Hampshire	7	162	W	W
New Jersey	158	531	157	408
New Mexico	43	68	51	45
New York	313	1,666	326	2,021
North Carolina	132	178	125	148
North Dakota	27	4	35	W
Ohio	351	1,361	371	1,300
Oklahoma	40	61	41	66
Oregon	W	W	41	W
Pennsylvania	192	1,114	186	996
Rhode Island	10	82	15	W
South Carolina	37	25	40	21
South Dakota	53	27	56	28
Tennessee	120	535	122	557
Texas	95	187	322	237
Utah	313	W	108	W
Vermont	6	156	6	W
Virginia	103	147	99	108
Washington	161	W	120	(1)
West Virginia	22	161	23	136
Wisconsin	176	544	178	716
Wyoming	20	3	29	3
Other ²	591	373	431	2,945
Total ^{3,4}	6,180	13,640	5,926	15,044

W Withheld to avoid disclosing individual company confidential data; included with "Other."

¹ Less than 1/2 unit.

² Includes shipments to overseas areas administered by the United States, Puerto Rico, exports, some shipments to unspecified destinations, and States indicated by symbol W.

³ Data may not add to totals shown because of independent rounding.

⁴ Differs from totals in tables 2, 4, and 5 because of changes in inventory.

quired 2%, totaling 60% for the chemical industry as a whole in 1972. This compared with 61% for the previous year.

The second largest use of salt was for deicing streets and highways and for roadbed stabilization. This use, which is tabulated in table 7 opposite "Highway use," formerly "States, counties, and other political subdivisions (except Federal)," required 20% of the salt output in 1972 compared with 18% in the previous year.

Salt used for food and food-related uses was 6.5% of the total consumed compared with 6.4% in 1971. The categories included in food-related consumption were as follows: Meat packers, tanners, etc.; fishing, dairy, canning, and baking; flour processing; other food processing; and grocery stores. Salt sold to grocery stores was assumed to be largely for table use; however, some salt in this category may have been used for water softeners.

PRICES

Prices per 100 pounds of salt quoted in Chemical Marketing Reporter for various grades in 1972 were as follows:

	January	June	July	December
Salt, evaporated, common, in bags, carlots, or truck lots, works.....	\$1.43	\$1.43	\$1.43	\$1.43
Salt, chemical-grade, same basis.....	1.54	1.54	1.54	1.54
Salt, rock, medium, coarse, same basis..	.97	.97	.97	.97
Salt, rock, extra coarse, same basis..	1.02	1.02	1.02	1.02

The average value of evaporated salt reported by producers to the Bureau of Mines in 1972 was \$21.26 per ton. On the same basis the average value of rock salt was \$6.31, and that of salt in brine was \$3.29.

FOREIGN TRADE

Exports of salt increased 30% in 1972, compared with the 1971 figure, but were less than 2% of the total production. Canada and Japan were the chief recipients. Exports to Canada increased 58%, and exports to Japan decreased 15%.

Imports of salt decreased 10% in volume and 17% in value in 1972 compared with corresponding figures in 1971. Mexico became the chief supplier with 36% of the total; Canada, formerly our chief supplier, was second with 29%; and Bahamas with 25% was third. The remaining 10% came from several countries. Imports were 7.3%

of the apparent consumption for the United States in 1972.

Table 9.—Salt shipped to the Commonwealth of Puerto Rico and overseas areas administered by the United States

Area	1971		1972	
	Short tons	Value (thousands)	Short tons	Value (thousands)
American Samoa.....	199	\$11	545	\$23
Puerto Rico.....	19,060	1,856	20,055	2,247
Virgin Islands..	150	31	478	33

Table 10.—U.S. exports of salt, by country

(Thousand short tons and thousand dollars)

Destination	1971		1972	
	Quantity	Value	Quantity	Value
Australia.....	(¹)	34	(¹)	9
Bahamas.....	2	70	2	86
Canada.....	398	2,350	627	3,780
Costa Rica.....	1	25	1	29
Honduras.....	(¹)	20	1	23
Japan.....	260	1,100	220	924
Mexico.....	1	59	3	68
Netherlands Antilles.....	2	87	1	64
New Zealand.....	1	37	1	36
Panama.....	1	31	1	49
Philippines.....	(¹)	16	2	16
Saudi Arabia.....	1	70	1	141
South Africa, Republic of.....	1	16	2	17
Trinidad and Tobago.....	(¹)	3	1	13
Other.....	2	264	6	289
Total.....	670	4,182	869	5,544

¹ Less than ½ unit.

Table 11.—U.S. imports for consumption of salt, by country
(Thousand short tons and thousand dollars)

Country	1971 ¹		1972	
	Quantity	Value	Quantity	Value
Bahamas.....	865	3,328	875	3,429
Canada.....	1,457	7,059	1,001	4,581
Chile.....	280	873	182	493
Ireland.....	60	148	--	--
Mexico.....	1,056	2,595	1,250	2,853
Panama.....	--	--	31	84
Spain.....	18	47	--	--
Tunisia.....	106	299	45	131
United Kingdom.....	(²)	3	19	160
Venezuela.....	13	46	60	181
Other.....	(²)	31	(²)	62
Total.....	3,855	14,429	3,463	11,979

¹ Includes salt brine from Canada through Buffalo customs district for 1971, 1,000 short tons (\$1,089); Seattle customs district, 28,738 short tons (\$198,103).

² Less than ½ unit.

Table 12.—U.S. imports for consumption of salt, by class
(Thousand short tons and thousand dollars)

Year	In bags, sacks, barrels or other packages (dutiable)		Bulk (dutiable)	
	Quantity	Value	Quantity	Value
1970.....	45	625	3,491	12,704
1971.....	27	574	3,823	13,855
1972.....	26	535	3,437	11,444

¹ Includes salt brine from Canada through Buffalo customs district, 1,000 short tons (\$1,089); Seattle customs district, 28,738 short tons (\$198,103).

Table 13.—U.S. imports for consumption of salt, by customs district
(Thousand short tons and thousand dollars)

Customs district	1971 ¹		1972	
	Quantity	Value	Quantity	Value
Anchorage, Alaska.....	(²)	3	(²)	10
Baltimore, Md.....	382	1,117	261	863
Boston, Mass.....	332	935	213	482
Bridgeport, Conn.....	53	245	--	--
Buffalo, N.Y.....	34	149	40	191
Chicago, Ill.....	163	734	61	273
Cleveland, Ohio.....	120	561	31	151
Detroit, Mich.....	690	3,453	559	2,752
Duluth, Minn.....	40	188	43	204
Los Angeles, Calif.....	159	337	194	423
Milwaukee, Wis.....	318	1,469	174	806
New York City.....	137	550	142	551
Norfolk, Va.....	27	115	12	48
Ogdensburg, N.Y.....	(²)	3	4	24
Philadelphia, Pa.....	104	304	36	103
Portland, Maine.....	260	1,319	396	1,724
Portland, Oreg.....	161	258	320	745
Providence, R.I.....	140	486	28	86
St. Albans, Vt.....	(²)	(²)	53	3
San Juan, Puerto Rico.....	99	415	200	803
Savannah, Ga.....	200	739	223	827
Seattle, Wash.....	415	985	444	814
Wilmington, N.C.....	21	59	29	89
Other.....	(²)	5	(²)	7
Total.....	3,855	14,429	3,463	11,979

¹ Includes salt brine from Canada through Buffalo customs district for 1971, 1,000 short tons (\$1,089); Seattle customs district, 28,738 short tons (\$198,103).

² Less than ½ unit.

Table 14.—U.S. imports for consumption of salt, by use

Use	Thousand short tons	
	1971	1972
Government (highway use).....	1,954	1,987
Chemical industry.....	96	208
Water conditioning service companies.....	110	144
Other.....	344	493
Total ¹	2,505	2,831

¹ Data may not add to totals shown because of independent rounding. Disagreement with totals in tables 1, 11, 12, and 13 is because of incomplete data on the uses of imported salt.

WORLD REVIEW

Australia.—Dampier Salt Ltd. made its first shipment of salt to Japan from a 2-million-ton-per-year solar-salt-producing facility in western Australia. The newly expanded facility jointly owned by Japanese and Australian interests initiated production in 1971. A condition of oversupply on the international salt market was blamed for the temporary halting of shipments from Lefroy Salt Co., a smaller Australian firm.²

Brazil.—Essentially all Brazilian salt was produced by solar evaporation of seawater in the States of Rio Grande do Norte and Rio de Janeiro. A large salt terminal was expected to be completed at Areia Bronca in Rio Grande do Norte in 1972. The ter-

minal built on an artificial island was designed to accommodate ships ranging up to 100,000 tons. The salt was to be barged from and to the mainland.³

India.—Seawater continued to be the chief source of salt in India. It was recovered from coastal areas of Gujarat, Maharashtra, Kerala, Tamil Nadu, Andhra Pradesh, Orissa, and West Bengal. Salt was also produced from inland lake and subterranean brines at Sambhar Lake, Didwana, Phalodi Pachpadra, and Kuchaman.

² Mining Journal, London. First Salt Shipment to Japan. V. 278, No. 7133, May 5, 1972, p. 372.

³ U.S. Embassy, Rio de Janeiro, Brazil. State Department Airgram A-128, May 24, 1972, pp. 4-5.

Table 15.—Salt: World production by country (Thousand short tons)

Country ¹	1970	1971	1972 ²
North America:			
Bahamas.....	685	1,337	890
Canada.....	5,359	5,542	5,535
Costa Rica.....	8	12	13
Dominican Republic.....	41	42	43
El Salvador.....	35	34	32
Honduras ^e	30	30	30
Martinique ^e	330	330	330
Mexico.....	4,578	4,806	4,850
Nicaragua.....	15	20	22
United States (including Puerto Rico):			
Rock salt.....	14,170	13,700	14,434
Other salt:			
United States.....	31,726	30,377	30,587
Puerto Rico.....	32	29	29
South America:			
Argentina.....	1,056	910	940
Brazil.....	2,013	1,628	2,400
Chile.....	569	469	481
Colombia:			
Rock salt.....	587	372	384
Other salt.....	254	331	743
Peru.....	210	210	210
Venezuela.....	293	290	290

See footnotes at end of table.

Table 15.—Salt: World production by country—Continued
(Thousand short tons)

Country ¹	1970	1971	1972 ²
Europe:			
Austria:			
Rock salt.....	1	1	1
Other salt.....	542	580	551
Bulgaria.....	149	108	110
Czechoslovakia.....	235	237	240
Denmark ²	481	147	* 324
France:			
Rock salt and brine salt.....	* 4,815	4,679	4,439
Marine salt.....	* 1,429	1,378	* 1,300
Germany:			
East.....	2,408	2,448	2,480
West (marketable):			
Rock salt.....	* 9,177	7,407	7,695
Marine salt and other.....	2,339	2,427	2,425
.....	* 125	126	* 130
Greece.....			
Italy:			
Rock salt and brine salt.....	* 3,181	3,740	3,704
Marine salt.....	1,650	1,304	793
Malta.....	* 4	3	* 3
Netherlands.....	* 3,165	3,491	* 3,530
Poland:			
Rock salt.....	1,349	1,346	1,333
Other salt.....	1,851	1,916	1,985
Portugal:			
Rock salt.....	214	259	304
Marine salt.....	228	173	* 180
Romania.....	* 3,155	3,250	* 3,250
Spain:			
Rock salt.....	1,241	1,311	* 1,320
Marine salt ³	1,023	850	* 880
Switzerland.....	368	321	282
U.S.S.R.....	13,700	13,200	* 13,200
United Kingdom:			
Rock salt.....	1,936	1,991	1,539
Other salt.....	8,192	* 8,200	* 8,200
Yugoslavia.....	* 281	387	297
Africa:			
Algeria.....	110	123	119
Angola.....	97	100	105
Egypt, Arab Republic of.....	* 452	464	* 470
Ethiopia: ⁵			
Rock salt.....	11	11	11
Marine salt.....	276	309	309
Ghana.....	* 42	52	* 55
Kenya.....	* 43	48	31
Malagasy Republic.....	24	31	23
Mali.....	4	3	* 3
Mauritius.....	4	6	* 6
Morocco.....	63	59	50
Mozambique.....	* 32	31	* 31
Senegal.....	* 129	123	138
Somali Republic ⁶	2	2	2
South Africa, Republic of.....	463	389	408
South-West Africa: Marine salt ⁶	121	121	121
Sudan.....	58	64	66
Tanzania.....	46	39	* 44
Tunisia.....	331	387	364
Uganda.....	3	3	* 3
Asia:			
Afghanistan ⁵	42	* 40	* 40
Bangladesh (formerly East Pakistan).....	247	* 140	NA
Burma.....	173	205	232
Ceylon.....	71	95	174
China, People's Republic of ⁶	17,600	18,200	19,800
Cyprus.....	8	7	6
India (including Goa).....	6,160	5,986	7,165
Indonesia.....	69	46	55
Iran ⁵	430	430	* 440
Iraq.....	* 56	60	* 60
Israel.....	74	88	104
Japan.....	1,060	1,043	757
Jordan.....	23	26	26
Khmer Republic.....	140	140	40
Korea:			
North ⁶	600	600	600
Republic of.....	446	397	498
Kuwait.....	3	3	5
Laos.....	1	(?)	9
Lebanon ⁶	41	42	44
Malaysia.....	NA	NA	23
Mongolia ⁶	* 8	10	11

See footnotes at end of table.

Table 15.—Salt: World production by country—Continued
(Thousand short tons)

Country ¹	1970	1971	1972 ²
Asia—Continued			
Pakistan:			
Rock salt.....	349	380	670
Other salt.....	244	293	258
Philippines.....	232	260	242
Ryukyu Islands.....	7	7	• 7
Syrian Arab Republic.....	51	26	• 33
Taiwan.....	590	738	483
Thailand ³	• 176	176	176
Turkey.....	• 715	730	• 730
Vietnam:			
North ⁴	165	165	165
South.....	• 132	132	44
Yemen ⁵	• 87	96	22
Yemen, People's Democratic Republic of.....	97	73	• 70
Oceania:			
Australia.....	3,385	4,175	4,410
New Zealand.....	58	48	64
Total.....	• 161,081	158,931	162,560

² Estimate. ³ Preliminary. ⁴ Revised. NA Not available.

¹ Salt is produced in many other countries, including Cape Verde Islands and Libya, Mauritania, and Niger, but quantities are relatively insignificant or reliable data are not available.

² 1970 and 1971 data are sales.

³ Includes an average annual production in the Canary Islands of 15,000 tons of marine salt.

⁴ Includes small quantities of sodium sulfate and sodium salts other than sodium chloride.

⁵ Year beginning March 21, of year stated.

⁶ Marine salt only.

⁷ Less than ½ unit.

Rock salt was produced at Guma, Maudi District, Hunachal Pradesh. Reserves of rock salt in the Maudi District were estimated at 7.6 million tons.⁴

Italy.—The Trapani Salt Flats, the site of a solar salt industry for more than 2,000 years, will be closed according to an announcement by the Sicilian Government. Outdated, hand-labor production methods unchanged from the Middle Ages were

cited as an important factor in the closing. The fact that the land was more valuable as construction sites for tourists' cottages was also considered.⁵

Netherlands Antilles.—The first shipment of salt was made from the new solar salt facility of International Salt Co. at Bonaire on the Island of Aruba. The new salt facility was reported to have a potential production capacity of 400,000 tons per year.⁶

TECHNOLOGY

The increased use of road salt for "bare pavements" in the snow belt caused concern among ecologists, conservationists, and others involved with problems of environmental pollution. Numerous studies have been made of the environmental effects of the use of road salt in specific localities. One of these studies made in the east-central section of Massachusetts indicated that the continued use of road salt might increase the average steady-state NaCl concentration in ground water by 160 milligrams per liter (parts per million).⁷ Drinking water standards ranging from 250 to 500 parts per million have been recommended. Although the concentration of salt that may eventually occur in the ground water in eastern Massachusetts may not be harmful to the general population,

persons on special low-sodium diets may be adversely affected. About 22 tons per lane-mile per year were used to salt the roads in the area studied. The Salt Institute, a national association of salt producers, recommended "sensible restraint" in the use of deicing salt.

Production of salt from seawater by electro dialysis rather than by solar evaporation was expected to become a reality in Japan with the installation of a 150,000 ton-per-

⁴ U.S. Embassy, New Delhi, India. State Department Airgram A-276, June 23, 1972, p. 79.

⁵ U.S. Embassy, Rome, Italy. State Department Airgram A-8, Aug. 25, 1972, pp. 1-2.

⁶ Jacoby, C. H. Salt. Min. Eng., v. 25, No. 1, January 1973, pp. 46-47.

⁷ Huling, E. E., and Hollocher, T. C. Groundwater Contamination by Road Salt: Steady-State Concentrations in East Central Mass. Science, v. 176, No. 4032, Apr. 21, 1972, pp. 288-290.

year plant at Okayama.⁸ The operating labor costs of the new plant were one-sixth that for a solar plant, and the 16 electro-dialyzers occupied a fraction of the space that would be required by solar evaporating ponds for equivalent salt output. A second plant was expected to open at Nagasaki. The Nagasaki plant was to produce chlorine, caustic soda, and hydrogen as well as salt.

In the electrodialysis units, semipermeable membranes under the influence of an electrical potential separate the charged ionic particles from seawater producing a brine concentrate from which the salt is crystallized.

Rock salt resources of Oklahoma at depths ranging from 30 to 3,000 feet were estimated at 20 trillion tons in a report by an Oklahoma geologist.⁹ Examination of many gas and oil well logs throughout the State provided information on salt deposits which indicated that they were much larger than previously estimated. Three principal Permian salt sequences each 100 to 1,000 feet thick underlie the western half of the State. Individual salt beds are typically 5 to 30 feet thick and are interbedded with reddish-brown shale and possibly anhydrite and gypsum. In addition to the rock salt reserves, five natural salt springs in western Oklahoma produce an estimated total of 6,300 tons of salt per

day. The outflow of the springs produce a barren area called a salt plain. The only salt production in Oklahoma is by solar evaporation of brine on these plains. Production costs of salt either as brine or crystallized salt were said to be potentially lower than the average for the nation and could make Oklahoma competitive with the larger salt producing States.

A novel system for recovering geothermal energy was suggested in a patented process in which a "heat well" would be created at great depth in a salt dome or other deep-seated salt formation using available drilling equipment and techniques.¹⁰ Utilizing the high heat conductivity of solid salt formations the heat energy of the earth would be transmitted to the "heat well" where it would be removed and utilized by a suitable fluid circulating through a heat exchanger. The energy collected could be utilized in the mining and purification of salt by recrystallization or for other purposes.

⁸ Chemical Engineering, *Electrodialysis Is Offering Advantages Over Solar Basins for Salt Production*, V. 79, No. 3, Feb. 7, 1972, p. 22.

⁹ Johnson, K. S. *Gypsum and Salt Resources in Oklahoma*, Ind. Miner., No. 62, November 1972, pp. 33-39.

¹⁰ Jacoby, C. H. (assigned to International Salt Co.). *Salt Solution Mining and Geothermal Heat Utilization System*. U.S. Pat. 3,676,078, July 11, 1972, 6 pp.